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TRANSACTIONS

OF THE

NATURAL HISTORY SOCIETY

OF GLASGOW

(INCLUDING THE PROCEEDINGS OF THE SOCIETY).

VOL. V.

(New Series.)

1896-99.

With Twelve Plates.

GLASGOW: PUBLISHED BY THE SOCIETY
AT ITS ROOMS, 207 BATH STREET.
MARCH, 1900.

Printed by
Robert Anderson, 22 Ann Street,
Glasgow.

A1505

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ERRATA.

Page 12, line 33, delete the word "Survey."
,, 147, ,, 15, for "Atlantic" read "Pacific."

R. I. Academy
Of Science

Thomas King 1896

TRANSACTIONS

OF THE

Natural History Society of Glasgow.

In Memoriam—Professor Thomas King.

[Read 29th September, 1896.]

Thomas King [Pl. I.] was born on 14th April, 1834, at Yardfoot, a farm in the Parish of Lochwinnoch, Renfrewshire. The farm had been purchased towards the close of last century by his grandfather, and remained in the possession of his father, James King. It is pleasantly situated on a gentle slope on the south-west side of the railway, about half-a-mile from Lochwinnoch Station, and commands an extensive view of grassy and heather-topped hills, with the town of Lochwinnoch nestling at their base, and the silvery expanse of Lochwinnoch, or Castle Semple Loch, gleaming in the foreground, and fringed here and there with wood and coppice. Few spots in the lowlands present a prospect more peaceful and pleasing than this, whether viewed in spring, when the vale is clothed in a mantle of softest green; in summer, when the trees hang with thick clusters of rich foliage, and the plain is brightened with myriads of flowers; in autumn, when the distant hills are purple with blooming heather, and the woods glow with vivid tints of red and gold; or in winter, when loch and river are ice-bound, and spotless snow lies all around. How greatly this fair prospect was appreciated by him may be gathered from a few lines pencilled by his own hand, in which he says: "I have seen many views, but none to this day more satisfactory than the view from Yardfoot across the valley."

Here, amid delightful rural surroundings, his early years were spent. Long afterwards, when looking back to youthful experiences, and their effect in forming the tastes and stimulating the keen love of nature which so greatly influenced his life, he wrote: "I consider it one of the most favourable things in my life that I was brought up in the country."

Mr. James King was twice married. Of the first marriage one daughter survived, while the children of the second marriage were five in number. Thomas, the third son, is the subject of the present notice. In evidence of the affectionate relations which existed between the members of the family, it may be mentioned that for the last thirty years Mr. Thomas King and his brother Robert corresponded regularly every week.

During childhood his constitution remained very weak, so his earliest instruction was received at home. But although feeble in health, he was always so bright and cheerful, and his disposition so affectionate and amiable, as to make him universally beloved. Regarding this period of his life he has written: "I was a delicate child, and did not go to school till rather late. My first teacher was Mr. Ferguson, Glenhead, or Newton of Belltrees. This place is known for two or three things. Belltrees was the home of three poets—Semples of Belltrees—grandfather, father, and son. The son is the reputed author of the song, 'Maggie Lauder.' It was also the native place of Mary Semple, one of Queen Mary's Maries. The old mansion has entirely disappeared, but a yew-tree marks the site of the old garden. Of course, nobody told us of these things, but I read of them afterwards."

In 1854 the farm was sold, and the family removed to Glasgow, where, for the next three years, Mr. King studied in the Normal Training College of the Free Church of Scotland, with the view of qualifying himself for the teaching profession. He taught English in schools at Paisley, Chryston, and other places, from 1858 till 1862, and devoted his leisure hours to his favourite study of botany. He was afterwards appointed teacher of English and Botany in Garnet Bank Academy, Glasgow; but under the strain of this work his health completely broke down, and it became apparent that recovery could not be looked for unless in a more genial climate than that of his native land.

Having accordingly obtained an appointment in the school of Messrs. Goldfinch and Bluhm at Valparaiso, Chile (in which country his brother John had already taken up his abode), he sailed from Liverpool on 21st July, 1864, in the "Adam Sedgwick." Here, under the warm rays of a South American sun, his health rapidly improved; while he found pleasant occupation for periods of leisure in studying the fauna and flora of Chile, and in forming collections of birds, insects, shells, and plants—an occupation which must have afforded him a source of never-failing pleasure. But this bright and happy period was destined to be darkened with sorrow through the death of his elder brother, James, which took place at Carrizal on 5th February, 1870.

While engaged in his favourite pursuits, Mr. King made the acquaintance of several eminent South American botanists, including Dr. R. A. Philippi, Professor of Natural History in the University of Chile, Santiago, of whom he has given the following reminiscences:—"He was well-known in Europe before coming to Chile, having, I understand, made his mark by his writings on the shells of the Mediterranean. I was introduced to him in the Santiago Museum, and found him a little, cheery, active German, about sixty years of age. I was struck by the facility with which he could name the native plants. I had been slowly puzzling them out, but he could name them as fast as we could name ash or beech or elm.

"Shortly after the bombardment,* my brother went north to the Desert of Atacama, to take charge of a mineral railway; and in my visits to him I was so fortunate as to find several plants new to science, as well as other species seldom seen in the south. These I sent to Santiago, and Philippi was so good as to name some of the new species after me. One of my finds I was greatly pleased about. In riding over the sands with my brother, on a bright morning before breakfast, I noticed a plant unfamiliar to me. Dismounting, I gathered a prostrate, wiry, fragrant leguminous under-shrub. Now, we had just got a new President —Señor Errazuriz—and the Doctor named it in his honour *Errazurizia glandulifera*, Ph."

---

* The bombardment of Valparaiso, by Spain, under Admiral Pareja, which took place in April, 1866.

In the *Anales de la Universidad de Chile* for 1872 and 1873, Philippi published a "Descripcion de las Nuevas Plantas incorporadas últimamente en el Herbario Chileno." This work, which was also issued separately in two parts, contains critical notes on nearly 350 flowering plants and vascular cryptogams, most of which are there described for the first time. In the notices of 29 species or varieties, "El Señor don Tomás King" is referred to by name as having furnished specimens from localities in North Chile. The following, which were thus supplied by him, are described as new to science :—

TROPÆOLEÆ.

Tropæolum Kingi, Ph.—*An. Univ.* (1872) 684.

LEGUMINOSÆ.

Errazurizia, gen. nov.—Ph., *An. Univ.* (1872) 688.
E. glandulifera, Ph. ,, ,, ,, 689.
Adesmia parvula, Ph. ,, ,, ,, 697.
A. Kingi, Ph. ,, ,, ,, 706.
A. elata, Clos, var.? ,, ,, ,, 707.
A. eremophila, Ph., var.? ,, ,, ,, ,,

PORTULACACEÆ.

Tetragonia pedunculata, Ph.—*An. Univ.* (1872) 717.
T. microcarpa, Ph., var.? ,, ,, ,, ,,

UMBELLIFERÆ.

Gymnophyton Kingi, Ph.—*An. Univ.* (1872) 727.

RUBIACEÆ.

Cruckshanksia densifolia, Ph.—*An. Univ.* (1872) 730.
C. chrysantha, Ph. ,, ,, ,, ,,
C. capitata, Ph. ,, ,, ,, 731.

VALERIANEÆ.

Valeriana senecioides, Ph.—*An. Univ.* (1872) 735.

COMPOSITÆ.

Haplopappus paniculatus, Ph.—*An. Univ.* (1873) 490.
Senecio balsamicus, Ph. ,, ,, ,, 499.
Cotula valparadisea, Ph. ,, ,, ,, 503.

LOBELIACEÆ.

Tupa ovata, Ph.—*An. Univ.* (1873) 507.

ASCLEPIADEÆ.

Schizostemma, gen. nov.—Ph., *An. Univ.* (1873) 509.
S. Kingii, Ph. „ „ „ „

BIGNONIACEÆ.

Argylia villosa, Ph.—*An. Univ.* (1873) 512.

BORAGINEÆ.

Heliotropium longistylum, Ph.—*An. Univ.* (1873) 515.

SCROPHULARINEÆ.

Mimulus Kingi, Ph.—*An. Univ.* (1873) 528.

POLYGONEÆ.

Chorizanthe Kingii, Ph.—*An. Univ.* (1873) 536.

AMARYLLIDEÆ.

Alstrœmeria Kingii, Ph.—*An. Univ.* (1873) 548.

LILIACEÆ.

Dicolus, gen. nov.—Ph., *An. Univ.* (1873) 550.
D. cœrulescens, Ph. „ „ „ 551.
Stemmatium, gen. nov. „ „ „ „
S. narcissoides, Ph. „ „ „ „

Besides the collections of animals and plants retained for his own use, the bulbs and seeds of many showy Chilian flowers were also gathered and transmitted to Britain by Mr. King, with the view of bringing them under the notice of horticulturists in this country. In 1892, a similar collection was obtained by him from Chile, and presented to the Royal Gardens, Kew. Among the plants included in this collection was *Argylia canescens*, D. Don (*Edinburgh New Philosophical Journal*, 1829, p. 88), which is figured and described in *Curtis's Botanical Magazine*, 3rd Series, No. 605 (May, 1895), Tab. 7414. *Argylia* is there described as "a very remarkable genus of *Bignoniaceæ*, confined to the Andean regions of Chili and Peru. . . . . The genus is here for the

first time figured from a specimen cultivated in Europe. It was presented to the Royal Gardens, Kew, by Thomas King, Esq., of Garnet Hill, Glasgow, in 1892, along with a collection of seeds and bulbs from Valparaiso. It flowered in a cool house in July, 1893, and again in 1894. The plant is not uncommon in Chili, from the latitude of Concepcion to that of Coquimbo, ascending to 7,000 feet on the Andes."

After an absence of nine years, Mr. King longed once more to see his friends at home, and to revisit the familiar scenes of early life, and he felt that the time had come when that cherished desire might with safety be gratified. He accordingly resolved to visit Scotland, and afterwards to return to Chile, where most of his possessions were still allowed to remain.

He reached home on 29th March, 1873, and spent the summer months with his father and mother. During the Summer Session of that year, he attended the Botany class of the late Professor Alexander Dickson, M.D., in the University of Glasgow, and was pleased to find that his health had become so far restored as to warrant the belief that he would be able not only to reside permanently in this country, but to devote himself once more to educational work. The intention to return to Chile was therefore finally abandoned; and during the Winter Session of 1873-74 he attended Professor John Nichol's class of English Literature in the University, besides obtaining teaching engagements in various schools in the city. In the following summer (1874) he again attended Professor Dickson's class of Botany.

In 1877 he was appointed to the lectureship on Botany in the Glasgow Eastern Mechanics' Institute, which had become vacant through the resignation of his cousin, Dr. John Mathie. In the following year (1878) he received a similar appointment in the Glasgow Mechanics' Institute, which was afterwards known as the College of Science and Art, and was in 1886 incorporated in the Glasgow and West of Scotland Technical College.

During the next few years, the periods of freedom from class engagements, which he enjoyed during the summer months, were set apart to study. In 1878 he attended Professor Bayley Balfour's lectures on Botany in the University, and, in the following year, his course of instruction in Practical Botany. In 1883 he went to London, where he attended lectures on Botany

and instruction in laboratory work at South Kensington. In the same year he obtained the certificate of the Department of Science and Art as a teacher of Botany.

In 1889 he was elected Professor of Botany in Anderson's College Medical School, and in the following year was appointed Professor of that science in the Glasgow Veterinary College. Besides the various lectureships mentioned, which he continued to hold at the time of his death, he had various engagements in schools and educational institutions throughout the city and its suburbs.

As a teacher, his lectures were always fresh and interesting, and distinguished by simplicity and clearness of language, as well as by an earnestness of purpose which showed that his work was indeed a labour of love. To listen to him was to feel that he was not merely an accomplished student, but a true lover of nature whose heart responded to all that was pure and beautiful in the world around him. Whether in the class-room or at the excursions which he frequently made with his students, his aim was not only to impart information but to awaken a real interest in those objects and pursuits which were the joy of his own life. Many of his students have acquired honourable distinction; while not a few members of our own Society, and others who take a prominent place amongst us as naturalists, owe much of their enthusiasm to his teaching and influence. But his success as a teacher was also largely due to his personal character; to the gentleness and courtesy of his bearing, which never failed to inspire confidence and respect; and to his kindly interest in his pupils, which led each of them to regard him as a friend.

But his sympathies extended over a much wider range than the sphere of his professional labours. He derived much pleasure from friendly association with others of like tastes, and took an interest in the work of local scientific societies, of most of which he was an active and esteemed member and office-bearer.

On 16th April, 1874, he was admitted a member of the Geological Society of Glasgow, while in 1878 he was elected a member of Council for three years, and was re-elected for a similar term in 1895. In 1877 and 1883, papers relating to the Geology of the desert region of Atacama, North Chile, were read by him to the Society. Although frequently at the meetings, he did not

usually take part in discussions unless appealed to on some botanical point by the chairman. This was no doubt due to the unobtrusive and retiring disposition which formed a marked feature in his character.

On 21st April, 1874, he exhibited a case of Chilian insects at a meeting of the Glasgow Society of Field Naturalists, and at the following meeting (5th May) he was elected a member of that Society. At many subsequent meetings he exhibited specimens, which included collections of beetles, butterflies, marine shells, plants, &c., from Chile and South Patagonia. Various papers on Botany and Natural History were also read by him to the Society. On the occasion of the visit of the British Association to Glasgow in 1876, an attempt was made by members of the Field Naturalists' Society to compile lists of the local fauna and flora. The catalogue of Mammalia, which includes 33 species and varieties, was prepared by Mr. King; and it still remains the most recent contribution to our local natural history, so far as the department to which it relates is concerned. In 1877 he was elected a member of Council. On behalf of the Field Naturalists' Society, he took a prominent part in the negotiations which resulted in its fusion with our own Society in 1879.

The Glasgow Eastern Botanical Society was founded in April, 1876, by Dr. Mathie (then Lecturer on Botany in the Eastern Mechanics' Institute) and by some of his students. Mr. King joined as a member at the first meeting. When he afterwards succeeded Dr. Mathie as Lecturer in the Institute, he also assumed the presidentship of the Society, which he has ever since retained. The continued prosperity of the Society has been largely due to his influence and aid.

On 30th October, 1878, he was elected a member of the Natural History Society of Glasgow, and in the following April, at the close of the session, the negotiations for union with the Field Naturalists were brought to a successful termination. One of the conditions under which the union had been effected was that a Summer Session should be established, and in 1879 Mr. King acted as Secretary during the first Summer Session of the united Societies. In the following October he was elected a member of Council, and in 1880 he again acted as Summer Secretary. In October, 1880, his appointment to the Council was renewed for a

full term of three years, and again, in 1884, for a like period. In 1886, however, he was elected a Vice-President; and, on the expiry of the triennial term of office in 1889, he was once more appointed a member of Council. On 31st October, 1893, he was unanimously elected President of the Society, which office he continued to hold at the time of his death. He also frequently rendered important services as a member of the Library, Museum, Research, Microscopical, Publishing, Summer, and other Committees appointed by the Council.

It may now afford us some gratification to remember that during what have proved to be the closing years of his life he has enjoyed the highest honour which the Society could bestow. Never was that honour more worthily conferred; never have its duties been more faithfully performed. As President, he occupied the chair at nearly every meeting of the Society and Council since the date of his election, although he often expressed a wish that the Vice-Presidents should, when present, be allowed to exercise that privilege.

Throughout the period of nearly eighteen years during which he has been connected with our Society, he was rarely absent from a meeting. Although his numerous other engagements occupied nearly every evening, these were so arranged as to admit of his regular attendance at our meetings. His circle of friends in the Society was very large, for nearly everyone knew him, and all who knew him regarded him with feelings of friendship. The meetings were to him a source of keen enjoyment. Like every true naturalist, he found pleasure not merely in acquiring information but in imparting it; and his readiness at all times to do so is apparent from the records of the Society, which show that he was an exhibitor of specimens at more than a hundred meetings. These exhibitions extended over a wide range of objects—zoological, botanical, and microscopic—and frequently included large series of fungi and other plants, which were so clearly explained as to render them interesting and instructive to all present.

The papers and communications submitted by him to the Society were also numerous. They all relate to botanical subjects. Most of them have been published, either wholly or in abstract, in the *Proceedings and Transactions* of the Society.

For several years subsequent to 1881, when his paper on "The Cultivation of the Potato in its Native Country" was read to the Society, his attention was directed to the subject of the potato-disease. As the disease is unknown in Chile, he considered it probable that tubers imported from that country might possess a power of resisting the attacks of the fungus. Supplies were accordingly obtained, and distributed for experimental culture in various parts of England and Scotland. But the results of these experiments, which were embodied in three papers submitted to the Society, established the fact that imported tubers become at length affected with the disease when grown in this country.

The excursions in connection with his own classes interfered with his regular attendance at the excursions of the Society, but he was present at these whenever free from other engagements. No other botanist in our Society had so extensive an acquaintance with the local flora, and the excursions for fungi and algæ were generally placed under his leadership. His scrupulous accuracy, and habitual caution in determining species, have imparted to the stores of information which he has been instrumental in recording in the *Proceedings* of the Society a value which they would not otherwise have possessed.

In 1879 it was decided that in the autumn of the following year the Cryptogamic Society of Scotland should hold its annual conference in our city, under the presidentship of Dr. James Stirton, F.L.S., Glasgow. This Society had been established in 1874 to promote research in Scottish Cryptogamic Botany, and the attention of its members had been chiefly devoted to mycology. It was suggested that a local committee should be appointed to make arrangements for the conference, and also to arrange for an exhibition of fungi and other cryptogamic plants. The suggestion was brought under the notice of the Council of our Society by Dr. Stirton, and a committee was afterwards appointed, with Mr. King as its convener. This had the effect of inducing him to direct his attention more especially to mycology, which ever afterwards remained his favourite department of botanical research. With the view of awakening the interest of our Society in this subject, three papers on "Fungi," illustrated with drawings, specimens, and microscopic preparations, were read by him at meetings held during 1880.

He entered with much enthusiasm into the work of arranging for the conference and exhibition, which took place early in October of that year. The exhibition, which was held in what were then the Coal Exchange Buildings, West Regent Street, proved entirely successful; and the collection of fungi, which included thousands of specimens, in almost endless variety of size, shape, and colour, afforded a unique and interesting sight. This visit of the Cryptogamic Society led to important results. The conference, excursions, and exhibition were attended by nearly all the leading mycologists in Scotland, with most of whom Mr. King has ever since been on terms of warm friendship and frequent correspondence. He, along with Mr. William Stewart, the late Mr. Robert Turner, and others whose names are closely associated with local research in mycology, became members of the Cryptogamic Society, with the result that the study of this department of botany—usually one of the most neglected—has ever since been actively pursued in our own Society.

In 1883 Mr. King was appointed Honorary Treasurer of the Cryptogamic Society, in succession to the Rev. Dr. Stevenson, Glamis, who had become Honorary Secretary. During the last sixteen years, the conferences of the Society, held each year in a different part of the country, have been regularly attended by Mr. King. These small gatherings, where most of those present were eminent specialists in mycology, have always afforded him the keenest enjoyment, and had the effect of adding considerably to his own stores of knowledge.

He was one of the founders of the Microscopical Society of Glasgow, which was instituted in October, 1884. Except during Session 1891-92, he was an office-bearer continuously from the date of the Society's foundation until his death. In 1884 he was elected a member of Council; from 1888 to 1891 he acted as a Vice-President; from 1892 to 1895 he held the office of President; and in 1895 he was again elected a Vice-President, which office he continued to hold at the time of his death. His skill as a microscopist, combined with a thorough knowledge of the structure and functions of vegetable tissues, and extensive acquaintance with the lower forms of plant life, enabled him to bring before the Society a large number of interesting objects, while the papers read by him were both numerous and varied.

His connection with the Glasgow Naturalists' Literary Club dates from its formation on 8th December, 1888. He was one of the fourteen original members who had been asked by the founders to join the club and were present at its first meeting. During the period between 10th January, 1891, and 24th November, 1894, he contributed three papers on "Plant Names, Popular and Scientific," "Early English Botanists," and "Two South American Naturalists," The Hon. Secretary of the Club, Miss S. B. Robbie, writes as follows: "The last-mentioned paper was a very striking one. We seemed to see more of the Professor's inner mind that night than ever before."

Although not a member of the Andersonian Naturalists' Society, his interest in its work was manifested by occasional attendance at the meetings, where he sometimes exhibited specimens and read papers. He was also frequently present at the excursions, where he occasionally acted as leader.

To meet the requirements of his own students, an enlarged edition of Hennedy's *Clydesdale Flora* was edited and published by him a few years ago. It is perhaps to be regretted that the engagements of a busy life did not afford him more time for literary pursuits, for no one was better fitted than he to take up the work which Hennedy had begun, and extend it to those departments of cryptogamic botany which he himself had so successfully studied.

While most of the scientific papers which Professor King has published have appeared in the *Proceedings and Transactions* of our own Society, he occasionally contributed short notes to the *Annals of Scottish Natural History*, of which his friend Professor Trail, Aberdeen, is joint-editor. He was also frequently applied to by the editor of the *Scottish Farmer* for assistance in replying to botanical queries. Various notes bearing his initials, and relating to questions connected with agricultural botany, have appeared in the pages of that journal. To the *Ordnance Survey Gazetteer of Scotland* he also contributed a long article on the botany of this country, which contains much valuable information.

His connection with the Cryptogamic Society of Scotland, to which reference has already been made, is of special interest in its relation to the closing period of his life.

On Monday, 7th September, accompanied by one or two friends,

Professor King left Glasgow to attend the Conference of the Society at Fochabers. Next morning he seemed to have recovered from the fatigue of his long journey, and joined the excursion party in their search for fungi. The route lay over a rough hillside. After walking some distance he became over-heated, and feeling unable to proceed further he sat down to rest on a stone. Here he was seized with sickness and other symptoms of illness, but, after resting for a short time, he was able to follow the party in their return to the Gordon Arms Hotel. The same evening he attended the annual dinner, and took part in the subsequent business meeting of the Society, but retired early to rest. Next morning he appeared at the breakfast table, but was unable to take food; and he was attended by Dr. William Watson, Slateford, who fortunately was among the party. As symptoms of pleurisy were apparent, Mr. King was ordered to bed, and remedial measures were at once adopted. When absent from home, his custom had been to write to his sister every day; and in a letter written on the Thursday evening he informed her of his illness and of Dr. Watson's desire that one of his friends should be summoned to attend him. Mrs. Ritchie accordingly proceeded next day to Fochabers, taking with her some letters for her brother which had arrived in his absence. Among these was a communication from the editor of the *Scottish Farmer*, enclosing ears of rye affected with ergot, which greatly interested Mr. King. A note on the subject, written to his dictation by Mrs. Ritchie, was afterwards despatched to the editor of the *Scottish Farmer*, and appears on page 756 of the issue of 19th September, the same paper which contains an announcement of his death.

On Friday, 11th September, the members of the party who had attended the conference left Fochabers, and it was hoped by them that in a few days Professor King would have so far progressed towards recovery as to be able to return to Glasgow. This hope, however, was not to be realised. On the following Sunday a relapse with serious complications set in, and on Monday, 14th September, he passed peacefully away.

The sad announcement of his death came as a painful surprise to his wide circle of friends, most of whom had not even been aware of his illness.

On the afternoon of Friday, 18th September, his remains were interred among those of his kindred in the old churchyard which adjoins the Abbey of Paisley.

Mr. King was never married. For many years he has resided with his sister and her family, where, surrounded by loved ones, he has found a peaceful and happy home.

He was a member of Free Tron Church during the ministry of Rev. Dr. Walter C. Smith; and has since been connected with Renfield Free Church, of which the Rev. Dr. Marcus Dods (now Professor of Exegetical Theology in the Free Church College, Edinburgh) was formerly pastor, and which is now ministered to by the Rev. W. M. Macgregor.

As a Liberal Unionist, he was interested in the political and social questions of the time; but although holding decided views on these topics, he was not an obtrusive politician, and never courted discussion or sought to provoke argument.

However much his talents were esteemed and his attainments admired, it is perhaps as a friend and companion that his loss will be most keenly felt. A genial influence seemed to surround him everywhere, whether among his students, at meetings or excursions of societies, at social gatherings, or in the retirement of the domestic circle. The cheerfulness and quiet humour, which rendered him so delightful a companion, also found expression in his correspondence and in many of the papers he has written. Accompanied by a few of his botanist friends, he frequently visited the Cadder Woods, or other favourite resort, in search of rare fungi. At such times all cares were laid aside, and the pure enjoyment which he derived from even the most common things was itself a source of pleasure to his companions. It is the testimony of those who knew him long and well that they never once saw him angry. His character was one of rare beauty—his life as pure and guileless as a child's. Ever kind, gentle, courteous, and sincere, he was beloved by all who knew him, and it is scarcely possible to believe that he can have left behind him a single enemy. His love of peace, however, was never gratified at the expense of principle, for he was firm and unyielding in opposing whatever he believed to be wrong. The guiding principle of his life was a steadfast faith which rested upon things unseen—an earnest,

simple, and consistent piety, which was reflected in all that he said and did.

The place which he occupied in this Society can hardly be filled. Never has there been one so universally beloved by us; never was there one more worthy of our affectionate regard; never was there one whose loss we can more sincerely mourn. But although he has passed from our midst, the gentle influence of his spotless life still abides. May it furnish us with an ideal which will ennoble our own lives, awaken purer impulses, and stimulate us to more earnest work.

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In Memoriam—David Robertson, LL.D., F.L.S., F.G.S.

[Read 30th March, 1897.]

It has often been remarked, that Scotsmen who have attained to the highest places of honour, have frequently risen from the humblest ranks of life. Of such men our country is justly proud, for their lives exhibit what is truly best in the Scottish character. In them we may trace a high ideal which has ever been the guiding principle of action, a steadfastness of purpose which has remained unweakened by early disappointments and failures, and a spotless integrity which has never stooped to acts of dishonour. To such men success may come slowly, but it is almost certain to come at last, and to bear with it a crown of well-merited honours.

Our own city can claim to have been the birth-place of not a few distinguished Scotsmen, among whom the subject of the present notice must ever be accorded an honourable place. The story of his life, with its early struggles, privations, and hardships, has been ably told by his friend, the Rev. Thomas R. R. Stebbing, M.A., whose volume* contains the only authentic account of Mr. Robertson's career; and we must therefore freely acknowledge our indebtedness to it for most of the information now to be narrated.

David Robertson was born at Glasgow on the 28th day of November, 1806, reckoning by the "Old Style." Although the "New Style" had been introduced by Act of Parliament in 1751, the innovation had not yet become universally adopted.

His birth-place was in Great Hamilton Street, which at that time formed the main approach on the south from Glasgow to the neighbouring village of Calton. Three weeks after the birth of David his father died, leaving his wife and three children totally unprovided for. Owing to the mother's industry, however, and

* *The Naturalist of Cumbrae.* By the Rev. Thomas R. R. Stebbing, M.A. London, 1891.

her frugal habits, the household continued to be maintained without any external assistance. Besides acting as the bread-winner, she also attended to the instruction of her children, and little David received from her his first lessons in the alphabet and spelling-book. He was also taught by her to be truthful and honest, and to avoid getting into debt.

In those days it was not customary to send children to school at so early an age as at present; but in any case he could not have been sent early, owing to the weak state of his eye-sight through a severe attack of measles. For a time he was threatened with a total loss of sight, and his eyes were never afterwards able to bear the strain of continuous work. He did not therefore begin to attend school until nearly seven years of age, and remained there only twelve months, during which period his reading-lessons consisted of the Book of Proverbs, New Testament, and other portions of the Bible, while the only instruction he had time to acquire in writing was a single page of long strokes.

Owing to the difficulties which his mother experienced in providing for the wants of her household, she found it necessary to take little David from school when he was about eight years old, and obtain for him some employment. He accordingly entered the service of a farmer in South Lanarkshire, being engaged to herd cows during the harvest season. Although his home life had never been brightened by many luxuries, his experiences as a herd-laddie were full of hardships, which must often have pressed very heavily upon him. The routine of his daily duties was simple and rigid in the extreme, and during the five or six weeks of his employment at the farm it was never relaxed. He had to be at his post in every kind of weather. He was aroused from slumber before daybreak, and retired to bed after darkness had set in; and as he was denied the luxury of a candle, he never saw the interior of the loft, above the kitchen, which he occupied as a sleeping-apartment.

But brighter days were in store for him. After leaving the place just described, he went to a moorland farm called The Logach, in the Parish of East Kilbride, and tenanted by Mr. Thomas Young, where he was much more considerately treated by both master and mistress. For four or five years he continued in the service of Mr. Thomas Young, and his son Mr. John

Young, who occupied the neighbouring farm of Ardochrigg; and he acted successively as cow-herd, quey-herd, and shepherd. It was on the latter farm that he was promoted to the post of shepherd, when between ten and eleven years of age, and his lot was by no means an easy one. Many a night the herd never got to bed at all, but had to lie on the hay-stack, with a plaid as his only covering, lest he should over-sleep himself. When nearly fourteen years of age, his service was transferred to an adjoining farm, where his duty was to look after the sheep every morning, and assist with the other out-door work. The monotonous round of his daily toil on these moorland farms was broken by many incidents and boyish adventures, which have been fully chronicled by his biographer. These afford interesting glimpses of the lad's character and favourite pursuits, and throw light on many of the rural customs of the time, but we cannot afford them more than a passing reference.

It had been the oft-expressed wish of his mother that David should learn some trade, which he might either pursue constantly or resort to if at any time he should be unsuccessful in obtaining other employment. Although he had no great wish of his own to learn a trade, there were various reasons which induced him to follow his mother's advice, and chief among these was a desire to learn to write. A serious impediment in his speech rendered it difficult for him to carry on a conversation; and fearing that his stammer would stand in the way of success in business, he believed that he might be able to express himself more easily in writing than by word of mouth. When about seventeen years of age he accordingly entered the employment of his brother James as a hand-loom weaver, and made up his mind to take writing-lessons at an evening school during the winter months, but on the second night of the school only five pupils had come forward, and the class was discontinued. But although disappointed, young David did not allow his purpose to be defeated, for he purchased some round-hand and half-text copy-lines, and set diligently to work. He also got hold of an old letter, written in a style which had taken his fancy, and tried to imitate the penmanship as closely as possible.

But work at a hand-loom was not a form of employment which offered any sufficient prospect of advancement. Accordingly,

after spending nearly a year at this trade, he resolved to leave it; and he obtained an engagement at a limestone quarry near East Kilbride, having as his work to assist in the removal of soil from the portions of rock intended to be quarried.

At the age of eighteen he entered the service of a Mr. M'Asland, farmer, Newlandmoor, East Kilbride. Besides driving the milk to Glasgow, he had to take part in the out-door work, while his periods of leisure in the evening were devoted to attempts to increase his stores of knowledge. Among the subjects which he tried to study in this way were arithmetic and book-keeping. He had a day-book, ledger, and cash-book, in which were entered the transactions of the farm so far as these came under his own cognisance. As part of his work was to drive the corn to the mill where it was ground, and to bring the meal back again, he was able on one occasion, by reference to these books, to detect an attempted overcharge in the miller's account.

When he was about twenty-one years of age, his service was transferred to Mr. Thomas Ballantine, whose farm lay about three miles south of East Kilbride. It was agreed that at eight o'clock on the winter nights, after the horses had been fed by David, he should be allowed to attend a night-school at a place called Millwell, a few miles distant, to take lessons in arithmetic. As the book used in this school was "Gray's Arithmetic," in which he had already made considerable progress, he did not need to attend every night, but only when he met with some difficulty which had brought his calculations to a standstill. In this way he succeeded, by the end of the winter, in working nearly through the book. His aim in these studies was to become proficient in reading, writing, and arithmetic, so as to be able to raise himself above the position of a common labourer, if the opportunity for doing so should ever present itself. This laudable ambition induced him to take the important step now to be narrated.

About the year 1830, when he had reached the age of twenty-four, two of his old playmates—Robert Miller and John Miller—entered Glasgow College as divinity students. He began to think that he might succeed in the medical profession, but the friends to whom he mentioned this project tried to dissuade him from carrying it into effect. He himself had some doubts as to the prudence of the step he contemplated; but it appeared to him to afford

better prospects of improving his position, when the seven years required should have expired, than could be looked for if he continued to work as a farm labourer during that period. Before coming to a final decision on the subject, he went to Glasgow and obtained an interview with Dr. Robert Hunter, Professor of Anatomy in the Andersonian University. Dr. Hunter encouraged him to persevere with his studies, and assured him that students with a more defective utterance had been able to succeed well in their profession. He accordingly resolved to carry his bold scheme into execution.

From combined motives of economy and comradeship, it was arranged that he and his two student friends should occupy the same rooms. They hired an attic with two apartments, close to the Cross Steeple, and with two windows overlooking the Trongate. Each student took his turn at the cooking and other household duties; water was conveniently obtained on the stairhead; and a little girl, who lived on the same landing, acted as their messenger in any necessary errands. By an ingenious device of young Robertson's, the door was fitted with a latch which could only be opened by those initiated into the secret of its working; and thus the three students, who returned at different hours, were saved the trouble and expense of providing themselves with separate keys. These preliminaries having been satisfactorily arranged, David attended the lectures of Dr. Hunter, Professor of Anatomy, by whose advice his new career had been adopted.

To provide themselves with the necessaries of life, pay their class-fees, and supply the books and other requisites for their studies, Robert Miller and David Robertson resolved to commence an evening school for writing and arithmetic. They obtained a single apartment in a close in High Street a short distance above the Cross. Having hired some old furniture, they removed their belongings from the attics, and took up their abode in the schoolroom. In their new quarters, just as in the old, the cooking and domestic work were shared by them in turn. As Robert Miller was a beautiful writer, he prepared a number of large cards announcing the opening of the school. These were exhibited in some of the neighbouring shop windows; and as the fine penmanship attracted considerable notice, the young teachers were soon able to get together a fairly large class. Here their

labours were also shared, the writing being taken by Robert Miller, and the arithmetic by David Robertson.

The end of the winter session brought with it the close of the evening school and the separation of the two student friends. Robertson had again to face the problem of ways and means, for without some fresh source of income he could scarcely hope to attend college during the summer months. No employment need be thought of which would not leave him free during class hours, or which would make his clothes unfit to be worn at college. After several unsuccessful attempts to get suitable work, he at last obtained an engagement with a Mr. Douglas, dyer and renovator.

The first outbreak of cholera in Glasgow took place about this time. Medical students were offered a guinea a week for attendance on patients, and Robertson offered his services, which were accepted. But after considering the great risk to which he would expose the family with whom he lodged, and the workers at Mr. Douglas's establishment, he made up his mind not to attend the hospital. Soon afterwards he caught fever and erysipelas of a bad type, and as the result of these troubles fully a year elapsed before he could return to college.

His certificates of attendance on the medical classes have been preserved, and are as follows:—Courses in Anatomy, theoretical and practical, at the Andersonian University, under Dr. Robert Hunter, from 4th May to 26th October, 1831, from 8th November, 1831, to 25th April, 1832, and from 8th May to 25th October, 1832; lectures on Surgery, under Dr. James Adair Lawrie, from 8th May to 30th October, 1832; on Practical Chemistry, under Thomas Graham, F.R.S.E., from 8th May to 1st August, 1832, and from 5th November, 1833, to 25th April, 1834; on Materia Medica, at the Glasgow College, under Dr. Richard Miller, from November, 1832, to April, 1833; and attendance with Dr. Lawrie on his daily visits to his patients in the Glasgow Royal Infirmary, for a period of three months prior to 1st February, 1835. Besides the course of study above indicated, he attended the lectures of Dr. Brown, Professor of Midwifery, and served the required time as a dispenser in Dr. Forman's drug-shop in Bell Street. On one of Dr. Graham's certificates it is noted that his student had "pursued the study of chemistry with unremitting assiduity," but the others contain

merely a formal acknowledgment of attendance during the specified periods.

In the various situations he had filled he had proved himself a faithful and painstaking servant, and his good qualities enabled him to find favour with his employers, and had the effect of establishing relations of friendship and confidence between Mr. Douglas and himself.

During the months of summer, Mr. Douglas frequently resorted to Millport with his daughters, and Robertson, when free from home engagements, was often invited to accompany the family. At this time he was chiefly interested in chemistry and anatomy, and these visits to the country afforded him opportunities of cultivating the latter pursuit by the dissection of mice, birds, frogs, and other animals.

He had now fully recovered from his illness, was over thirty years of age, and had completed his course of study. All that remained was to present himself for final examination, obtain his diploma, and start life as a medical practitioner. A change, however, had gradually been taking place in his views, and the causes and purport of this change can best be understood from his own words. "I had reasoned with myself," he says, "that I had not any means of my own to make an independent start, and that if I struggled on till I was able to do so, the class of patients I should have, at any rate to begin with, would be much more numerous in their persons than their payments. Then there was another phase of the matter to be contemplated. In all the duties of the profession one is brought face to face with pain to a more or less distressing degree, nor is there any hour, night or day, that one can call one's own. But the greatest consideration with me was that all depended on myself. On the other hand, I thought that if I got into business, even in a small way, it might by industry and close attention increase and enable me to employ other hands as well as my own, and should illness or death overtake me, the business might be carried on without me. I was in good favour with my employer, Mr. Douglas, and his family. I had entered into an engagement with one of his daughters. He had, besides the dyeing establishment, a china and earthenware shop in Jail Square, Glasgow, in which my betrothed was an attendant.

"All had advised me, as before stated, not to enter the medical profession, and all now advised me to abide by it. But my determination was fixed, and nothing would now induce me to become a medical man.

"I had set my mind on having a small shop in the same line as that in which my betrothed was already employed. She could manage it, and I would continue in my present employment, which would now have all my time, and I should have more wages, which would enable me to keep the house, leaving the profits of the shop to pay rent and improve stock. A shop and upper flat for dwelling-house were taken on the west side of Jail Square, at a rent of twenty-five pounds a year. I was free of debt, but my whole stock of cash was only seven pounds, to marry, to furnish my house, and stock my shop. Still I did not despair. I had had a good lesson in economy, and I had no pride to sustain, and I had confidence in our combined energies."

The resolution at which he had thus arrived was speedily carried into effect. His slender capital was expended in stocking the shop with a cheap and useful class of earthenware goods, while during his spare time he painted and lettered the outside of the shop. The household furniture was supplied by Miss Douglas's friends. Everything being now arranged, the marriage took place in the year 1837.

Even in his less prosperous days, Mr. Robertson had always acted on the principle of keeping free from debt, and this principle was consistently followed throughout his business life. Early in the morning he attended at the potteries and selected the goods required for the shop. As novelties were occasionally asked for, these were judiciously added to the stock. Trade handbills were produced by him with the aid of a small printing-press lent to him by his father-in-law; these were distributed over the south side of the city, and led to a great increase in business. His wife's sister, Miss Grace Douglas, had married Mr. Daniel M'Dougall, and she and her husband had taken over Mr. Douglas's china and earthenware shop in Jail Square, next door to the Robertsons' establishment. A friendly rivalry was carried on for some time, but at length the houses were united under the firm of Robertson & M'Dougall. Soon after this union was effected, Mr. Robertson paid his first visit to the Staffordshire potteries, with the view of

arranging for the regular supply of goods of English manufacture, such as were then offered by several competing firms in Glasgow. But a period of advancing prosperity was darkened by heavy domestic bereavements. Mrs. Robertson, while visiting her mother, who was sick with fever, caught the disease, and died after a short illness. Two children—a son and daughter—had been born of the marriage, but both died young, the second child being buried at the same time as its mother. Soon after these sad events, Mr. Robertson made his home with his partner's family, with whom he continued to reside for a considerable time. Meanwhile the business of the firm continued steadily to increase from year to year.

Among the relatives of the M'Dougalls was a Mr. Alston, who lived in the Isle of Man. "In 1839," to quote from Mr. Robertson's biographer, "Mr. Alston had been left a widower, with an only daughter, named Hannah, then aged thirteen. At a still earlier period this little girl had become acquainted with David Robertson's name by being bidden to collect shells on the sea-shore for the benefit of a great conchological signboard he had been making. That she should ever see the man herself she had naturally then no expectation, nor, for the matter of that, any curiosity to do so. In the year 1842, however, it so happened that Mr. Alston brought his daughter to Glasgow to be introduced to her relatives, the M'Dougalls. With them also came a cousin. Mr. Alston was a very tall man, and when he entered the warehouse with a tall young lady on one arm, and his little daughter on the other, Robertson's attention was immediately arrested by the trio; and something apparently besides his attention must have been taken captive, for he seems to have made up his mind then and there that the little girl, on whom he had never set eyes before, should, if possible, become his wife.

"By some innocent manœuvring, Hannah Alston was induced to pay another visit to the M'Dougalls in Glasgow, coming this time without her father. As she had won David's heart without any effort of her own on the former visit, so on this, without much trouble, he either won or completed the conquest of hers. The M'Dougalls, who, of course, thoroughly well knew and highly valued Robertson, were, on their part, quite content, and so smoothed the path of the lovers that, with the least possible delay, they were married on September 11th, 1843."

Up to this time, the ceaseless round of duties had retarded the development of his taste for natural history. Without any definite aim in view, he had collected fossils from the Carboniferous shales in the various districts where his earlier years had been spent; and it is possible that a latent interest in the subject, as well as a desire to utilise these hoards, may have been the causes that induced him to attend a course of evening lectures on geology which were delivered by Mr. John Craig about the year 1837. But Robertson had just made his first start in business, so science had to be put aside for a time. About the year 1845, however, he became desirous of knowing the names of some of the mosses he had often seen and admired. He called upon Dr. James Rattray, a well-known lecturer on botany in Glasgow, whom he asked to visit him and give an hour's lesson on mosses several nights a week. Rattray, however, was not acquainted with mosses, and proved much better able to relate long stories than impart instruction in bryology. He advised Robertson to study flowering plants and leave the mosses alone, and in this decision the pupil was forced to acquiesce.

For several years after his marriage with Miss Alston, Mr. Robertson devoted a good deal of time to literary pursuits. Besides various poetical pieces, his thoughts and reflections in prose were committed to writing. Many of his prose essays, and humorous sketches in the lowland Scottish dialect, were published in the *Glasgow Herald*, and in the *Reformer's Gazette* of which Peter Mackenzie was editor.

The Natural History Society of Glasgow was founded on 2nd July, 1851. At the meeting on 5th October, 1852, Mr. Robertson was proposed for admission to the Society; and the form of application bearing his signature was also signed by Messrs. Roger Hennedy, Matthew P. Bell, and William Ingleton, as his proposers. At the following meeting (2nd November) he was elected a member. This connection had an influence greater than any other in developing his taste for biological research. Many congenial acquaintances were formed which ripened into lifelong friendship. Among the most intimate of his early associates in the Society was Roger Hennedy, Lecturer on Botany in the Mechanics' Institute, and author of the *Clydesdale Flora*. Hennedy was a recognised authority on flowering plants, and had

also an extensive acquaintance with seaweeds. As both he and Robertson resided at Millport during the summer, they had many pleasant rambles together, and Robertson's earliest experiences in dredging were acquired in his company. Under Hennedy's direction, Robertson became an enthusiastic collector of seaweeds; and in this delightful occupation, as well as in many of his later scientific researches, he found a talented and helpful colleague in his wife, whose tastes were very closely akin to his own. This pursuit brought him into correspondence with Dr. G. A. Walker Arnott, Professor of Botany in Glasgow University, and with Professor W. H. Harvey of Dublin, author of the *Phycologia Britannica* and numerous other standard works on algæ. One of Mrs. Robertson's relations, Miss Mary Ann Alston, had presented him with a collection of seaweeds from the Isle of Man, and in acknowledging her gift Mr. Robertson wrote as follows:—"Many thanks for the beautiful book of seaweeds you so kindly sent to me. I have a great love for the book of nature. It yields me inexhaustible sources of pleasure, and opportunities of seeing and admiring the beauty and extraordinary works of the great Designer. No one doubts the genuineness of His book. No one ventures to aspire to the smallest share of the work. It has no apocryphal portions nor misunderstood passages. The smallest blade of grass carries the unmistakable impress of its omnipotent Author on it. The tiniest plant, far beyond the reach of the unaided eye, demonstrates the beauty, the harmony, the perfection of His works. How much more interesting is a walk in the green fields or on the sea-beach when you can recognise in almost every plant an old acquaintance, and call them by their names. A collection of preserved plants teems with impressive memorials of the past, and calls up associations of happy days long gone by, bringing to memory dear companions who shared in the pleasure of gathering the specimens that are almost held sacred for these friends' sake."

Many a distinguished zoologist has, as it were, served an apprenticeship to science by first working in botany, and this was the case with Mr. Robertson. Up to the time when he became a member of the Natural History Society of Glasgow, he had never attempted the systematic study of zoology, and his earliest work in biology was confined to botanical research. While

dredging for seaweeds he had often brought up shells and other marine animals, and, as these had been carefully preserved by him, he gradually brought together an extensive collection. From John Gray and Thomas Gray, two members of this Society, he obtained assistance in the naming of the marine shells, which were then arranged in systematic order, and cabinets provided for their reception. Having now got fairly interested in marine zoology, he purchased some standard works on the subject, among which were G. B. Sowerby's *Illustrated Index of British Shells*, Forbes's *British Starfishes*, and Bell's *British Stalk-eyed Crustacea*. From this time onward to 1860, his visits to Millport were as far as possible devoted to searching for the treasures of the sea. He entered into correspondence with the leading authorities on the subjects which engaged his attention, and his discoveries soon attracted the notice of British and Continental zoologists. They also afforded materials for many communications to this Society. For a long period he continued to be one of the most frequent exhibitors of specimens at the meetings, while the papers submitted by him were also very numerous. Up to that time the information collected regarding the marine fauna and flora of the West of Scotland had been fragmentary and imperfect; but, besides furnishing stores of knowledge on these subjects, his communications contained a record of original observations and experiments on the life-history and habits of these organisms which has proved of the utmost value to students of biology. In gratefully acknowledging the influence which these communications have had in raising the Society to the position which it has since occupied, it is pleasant for us to remember that the Society itself was largely instrumental in developing Mr. Robertson's taste for natural history, and inducing him to engage in those pursuits which he so long followed with marvellous success, and with which his name will continue to be closely and honourably associated.

But his attention was directed to a much wider field than was afforded by the study of existing animals and plants. He was a keen and accomplished geologist, and was specially interested in the memorials of long-extinct forms of life.

About the year 1855 he joined the Rev. Henry W. Crosskey, F.G.S., in the preparation of a paper on the Post-Tertiary

Fossiliferous Beds of Scotland. This proved a most laborious undertaking, which extended over many years. Its results are published in a series of papers, five in number, contained in the *Transactions of the Geological Society of Glasgow*, vols. ii. to v. In course of time Messrs. Crosskey and Robertson were joined by Dr. G. S. Brady of Sunderland, one of the leading British authorities on the Entomostraca. Their joint labours resulted in the publication of a *Monograph of the Post-Tertiary Entomostraca of Scotland*, which was issued by the Palæontographical Society in 1874.

In 1858 Mr. Robertson suffered from severe illness. The strain of anxiety and trouble which this cast upon his wife had the effect of undermining her health, and in the following year she was involved in a prolonged illness, from which she very slowly recovered. Her medical attendant advised her speedy removal from Glasgow to Cumbrae, and intimated that she could never hope to be able to return to assist her husband in his warehouse in the city. It was therefore resolved that the hardware and fancy goods department of the business, which had hitherto been carried on by Mr. and Mrs. Robertson, should be sold, and that the glass and china department should be taken over by Mr. M'Dougall and his sons.

In 1860 Mr. Robertson finally retired from business; and as his wife's health still continued very unsatisfactory, it was arranged that she should be taken to Cumbrae in mid-winter.

The climate of Cumbrae proved beneficial in restoring Mrs. Robertson to health, so the house known as "Fern Bank," in Kames Bay, Millport, was acquired as a residence for the family during holiday seasons. While their two sons, David and Thomas, were still at school, and for some time after they had commenced business, a house in the city was retained. Owing to the state of his wife's health, in 1882 Mr. Robertson resolved to remove to the country, and he accordingly acquired the residence of Glendale, Uddingston; but, having found that in winter this locality did not suit his own health, he parted with the house to his elder son, and determined to make his home at Millport. Some additions were therefore made to Fern Bank, which since 1886 has been his permanent residence.

Having been set free from the cares of business, Mr. Robertson and his wife devoted their leisure to natural history. Besides

assisting her husband in his own favourite departments of research, Mrs. Robertson turned her attention to the study of the recent Foraminifera, of which she has formed a large and very valuable collection. Dredging excursions off the Cumbraes and along the neighbouring shores, as well as visits to more distant localities, were frequently carried out by them both.

In June, 1866, they visited Aberdeen and Banff, with the view of examining some of the Post-Glacial deposits in the North-east of Scotland. While at Banff they made the acquaintance of Thomas Edward, and inspected his collections. Friendly relations were ever afterwards maintained between Robertson and Edward, and they frequently corresponded with each other.

Later in the same year Messrs. Crosskey and Robertson were offered a free passage to Norway. This offer was accepted, as it afforded a favourable opportunity of collecting materials from the Norwegian Post-Tertiary beds. They sailed from London in the *North Star*, and Robertson took with him a letter of introduction from Dr. Gwyn Jeffreys to Professor Michael Sars, the celebrated zoologist. During the voyage from London to Christiania, Robertson met with an accident, which resulted in the fracture of his lowest rib. As his biographer remarks, "the accident retarded work at the clays considerably, but by the end of the week the invalid was able to be taken out, and when they came to any fossil banks, by being laid full length on the ground, he was able to pick out the fossils with some care. When he had to be lifted up on his feet again the pain was very great. But what is that to an enthusiast?" Meanwhile he had written to his wife informing her of his accident. Full of anxiety as to the possible consequences, she at once arranged for a few weeks' absence, and followed her husband to Norway. Their visit to the "land of the midnight sun" was full of interesting experiences, many of which have been duly recorded.

During the next few years the routine of work on the shores and in the deeper waters around Cumbrae was often varied by excursions to other localities, from all which Mr. Robertson brought home abundant trophies of successful research.

In 1867 he and Mrs. Robertson visited Shetland, for the purpose of studying the Entomostraca and Foraminifera of that group of isles. In 1868 he accompanied Dr. G. S. Brady in a

dredging expedition to the West of Ireland. In May, 1869, accompanied by his wife, he visited the Post-Tertiary deposits in the East of Scotland, between Edinburgh and Montrose; and in the following month he went with Dr. Brady to the Norfolk broads in quest of fresh-water Ostracoda. Equipped with a new and improved type of dredge, specially designed by himself for work among the fens, he afterwards paid a second visit to the East of England. In company with Dr. Brady, he made another expedition to the West of Ireland in May, 1871, and later in the year he visited Brady at Sunderland. In 1872 he devoted some time to the study of the geology of the district round Campbeltown Loch, while in July of that year he received at Fern Bank a visit from his friend Brady. In June, 1873, he accompanied Brady in a dredging excursion to the Scilly Isles. In May, 1874, his wife and he went to the Isle of Man to visit Mrs. Robertson's relations, while in the following July he was at work on the east coast of England. In this latter expedition, which was undertaken under a grant from the British Association, he was accompanied by Dr. Brady and the Rev. A. M. Norman. Later in the same year he and Mr. Norman visited the West of Ireland.

In 1876 the British Association met at Glasgow. The prospect of this influx of distinguished visitors had excited considerable activity in local scientific circles, and various publications were issued as guides to the natural history and geology of the district. Among these was a *Catalogue of the Western Scottish Fossils*, compiled by James Armstrong, John Young, and David Robertson, with an introduction by Professor John Young, M.D., Glasgow University. In his preface to the volume Professor Young remarks that "Mr. Robertson has supplied a great want by his complete list of glacial fossils."

His stores of information were also made available in the preparation of another volume, entitled *A Contribution towards a Complete Catalogue of the Fauna and Flora of Clydesdale and the West of Scotland*, which was compiled under the auspices of the Glasgow Society of Field Naturalists. In this work the lists of Recent Marine Mollusca, Actinozoa, and Foraminifera have Mr. Robertson's name appended to them. Unfortunately, however, the catalogue of Marine Mollusca was prepared by a member of the Field Naturalists' Society who had merely noted the localities

indicated on specimens in Mr. Robertson's collection, but attached the latter's name to the list. As the catalogue which had thus been submitted in Mr. Robertson's name contained omissions and inaccuracies for which he was in no way responsible, a corrected list was afterwards compiled by him and published by the Field Naturalists' Society, with a suitable apology for the error to which the Society had been an involuntary party.

In the years between 1877 and 1880, visits were made by Mr. and Mrs. Robertson to North Wales, Peebles, and the Hebrides. With the latter year commenced a period of domestic troubles and bereavements. He himself suffered from illness; his elder son's wife died in 1880; in 1881 Mrs. Robertson had several attacks of severe illness; while in 1882 the younger son also lost his wife, and was left with three very young children.

The Marine Biological Station at Granton was established in 1884, under the supervision of Dr. John Murray, of the *Challenger* Commission. In the following year the steam yacht *Medusa*, which had been specially fitted up for marine research, was taken to Glasgow for repairs, and the occasion was regarded as a favourable opportunity for investigating the fauna of the waters around Cumbrae and Arran. The cruise of the *Medusa* in the Firth of Clyde is thus chronicled in the Report of the Granton Station:—"In March, 1885, a second visit has been made to the west coast. Dredging operations were conducted for a period of six days by Mr. Henderson,* and Mr. F. G. Pearcey, of the *Challenger* Commission, in Loch Long, round Cumbrae, and in Rothesay and Lamlash Bays. On three days they were accompanied by Mr. David Robertson, of Glasgow, the well-known Clyde naturalist, and to his kind assistance and guidance the short trip owed much of its success. Many rare and interesting animals were procured, not a few of which are unknown on the east coast, thus suggesting some interesting distributional problems. It is hoped that the foundation of a branch of the Scottish Marine Station on the Clyde will lead to an accurate comparison of the faunæ and floræ of the two estuaries, and, in this way, clear up some obscure points in our knowledge of the distribution of British marine animals and plants."

Immediately after the departure of the *Medusa*, Mr. Robertson wrote to his friend Dr. John Grieve as follows:—"Mr. Murray

* Now Professor of Biology in the Christian College, Madras.

has it in contemplation to have a marine station somewhere on the West of Scotland. Arran had been strongly recommended, but when they saw the extent of rich dredging ground, and variety and extent of shore, all within so short a distance of the central point, Millport, besides an easy run to all the lochs of the Firth, they were all in one mind that Millport was greatly preferable to Arran or any other place that had been thought of. Fortunately all round Cumbrae the dredging was exceedingly successful. Where they think would be most suitable for the site of the station is on one of the Allans."

As a preliminary step towards the establishment of a permanent station, a barge named the *Ark*, which had been fitted up as a floating laboratory, was brought from Granton to Millport, and drawn up on the rocks above high-water mark. The pleasure with which Mr. Robertson contemplated the fulfilment of what had long been a cherished desire may be gathered from his correspondence. Writing to Dr. J. R. Henderson, who was then about to leave for India, he states that—"To keep up old associations, Mrs. Robertson and I take a walk to the *Ark* every day. We have had some heavy weather for the last few days, with high tides, but the *Ark* is keeping her ground well, which is giving us hope that she will come safely through the winter." In April of the following year he wrote to Dr. Murray as follows:—"I got the chain of the *Ark* tightened up a little. I am getting the rock on her west side cut away, which will be a great safety to her. I would be sorry to see any mishap overtaking the old lady. We had a pretty sharp gale last night, but she is still all right."

As an addition to the sights of Millport the *Ark* proved a centre of attraction even to unscientific visitors. "During the summer of 1889," writes Mr. Stebbing, "an experiment was made to test the interest which the public would take in it. An intelligent attendant was paid to take charge of it, and empowered to admit visitors at a fixed charge. A discussion took place as to what the charge should be. One of the financial committee recommended that it should be sixpence, another thought that threepence would be enough, but Mr. Robertson carried the day for his own view that only a penny should be asked. Yet so much interest was shown in the boat and its contents that five to seven or eight shillings a day in pennies were received throughout

the season, without counting the larger extra donations frequently given to the attendant for his own perquisite. Mr. Robertson sometimes ventured to hint to single visitors that it would be more appropriate and in accordance with precedent if they came to the *Ark* in pairs. Since the fee was expressly intended to keep out such idlers and disreputable persons as deserve to be classed under the name of the 'Great Unwashed,' he might have gone further and suggested that clean animals should enter by sevens. He is not averse to telling the story that one day, while he was himself working in the *Ark*, with no other companions but its marine treasures, a stranger came in and looked inquiringly round. The gentleman was invited to inspect the various curiosities, and he listened with attention to all that was said about them by one who was no unwilling expounder of their various merits. When all the wonders had been duly displayed, and the tale of their virtues fitly told, the stranger expressed himself much pleased, and with very polite and often-repeated thanks withdrew. But this was not all, for Mr. Robertson concludes, with a pleasant twinkle, 'he slippit also a shilling into my hand.'"

Although the weight of advancing years had gradually been imposing its physical restraints upon him, his capacity for scientific research remained almost unimpaired. In a busy life such as his, there were no periods of idleness. His own accumulated stores of marine treasures might alone have afforded abundant materials for continuous work, but he still found time for research in more extended fields. Portions of the material dredged in the *Challenger* Expedition were examined and reported on by him. Frequent demands on his time were also made by other workers who desired to avail themselves of his experience, and to all such he was ever ready to afford assistance and encouragement. Among his most recent undertakings was an examination of the shell-deposits of Clava, in the North of Scotland, and Kintyre, in the West. Last May he attended a geological excursion to the latter district, and afterwards compiled part of an elaborate report on the deposits, which was submitted in September to the meeting of the British Association.

Throughout the period of forty-five years during which his attention was directed to the marine fauna and flora, he corresponded with the most eminent specialists in Britain and on the

Continent. Nearly every standard work in these departments of science, published during that period, contains acknowledgment of assistance received from him. The most distinguished biologists have borne testimony to the success of his researches and the value of his contributions to science, and among the names of such may be mentioned Professor Koelliker, Dr. Gwyn Jeffreys, Professor G. S. Brady, Mr. H. B. Brady, Rev. Canon A. M. Norman, Dr. Anton Dohrn, Professor Michael Sars, and Dr. John Murray. At least one genus, and more than a dozen species, have been named in his honour, while the species described from specimens discovered by him have been very numerous.

He submitted many papers to the societies with which he was connected, as well as to various scientific journals. Of these, the largest number was communicated to our own Society, but others, contributed wholly or partly by him, appear in the *Transactions of the Geological Society of Glasgow*, *Proceedings of the Philosophical Society of Glasgow*, *Transactions of the Geological Society of London*, *Quarterly Journal of the Geological Society*, *Reports of the British Association*, *Quarterly Journal of Microscopical Science*, *Annals and Magazine of Natural History*, &c.

Having been admitted a member of the Natural History Society of Glasgow in 1852, soon after its formation, he afterwards held office for some time as a Member of Council, and was several times appointed a Vice-President. In September, 1887, he was unanimously elected President of the Society for a full term of three years. Although, for a long period, he was unable to be present at any of the meetings, his interest in the Society's welfare remained undiminished. This was fully shown by the specimens and communications which he continued to submit to the meetings, and which in number far exceeded those contributed by any other member.

In 1859 he became a member of the Geological Society of Glasgow. The same year he also joined the Philosophical Society of Glasgow, of which he continued a member for about 18 years.

In 1865 he was elected a member of the Royal Imperial Zoologico-Botanical Society of Vienna, and received its diploma. In 1876 he was elected a Fellow of the Linnean Society of London, and in 1877 a Fellow of the Geological Society of London.

In 1895 the University of Glasgow conferred on him the honorary degree of LL.D., in recognition of his eminent attainments as a naturalist.

In the case of not a few men, engrossing studies seem to have the effect of inducing habits of isolation and exclusiveness which tend to check the flow of the benevolent sympathies. But it was not so with Robertson. He desired that the study of marine zoology, which had yielded himself an endless round of the purest pleasures, should also be taken up by the inhabitants of Millport, as well as by the visitors who flock thither during the summer months. With this end in view, he exhibited portions of his collections in the public halls at various times, and read explanatory papers, written by himself in a style fitted to awaken popular interest in the subjects to which they related. As already indicated, he took an active interest in promoting the establishment of a Marine Biological Station at Millport, and had promised to its museum the greater part of his own unrivalled collections. He lived to see the approximate fulfilment, if not the complete realisation, of this cherished scheme.

Encouraged by the success which had attended the opening of the *Ark* as a temporary station, he aimed at the erection and endowment of a building in all respects suited to the requirements of marine research. Mainly through his own personal efforts, an influential committee was appointed to raise the funds and make the arrangements necessary for carrying the scheme into effect. A free grant of a site on the shore near Keppel Pier has been obtained from the Marquis of Bute, and on this has been erected a handsome structure of red sandstone, which is now approaching completion. The first sod was cut by Mr. Robertson on 7th August, 1896, and on 17th October the foundation-stone of the building was laid by Dr. Thomas Reid, LL.D. Much to Mr. Robertson's regret, he was prevented by illness from being present at the ceremony.

From this attack of illness he never recovered. After lingering five weeks, during which his resources of strength were gradually exhausted, his death took place on the evening of Friday, 20th November.

On Tuesday, 24th November, his remains were interred in the cemetery adjoining Cumbrae Cathedral, where the burial service

was conducted by the Very Rev. Provost Ball, LL.D., in accordance with the rites of the Scottish Episcopal Church.

Mr. Robertson is survived by his wife and by two sons, the younger of whom is the well-known artist, Mr. Tom Robertson.

It is scarcely possible to estimate fully the loss which science has sustained in the removal of one whose fruitful labours have extended over well nigh half-a-century. His endowments were of no ordinary kind. His habits of perseverance and endurance, disciplined by the hard experiences of early life, were combined with the keenest powers of observation, scrupulous accuracy in recording facts, and the most exact method in arranging scientific details. He was never elated by his successes, but esteemed the facts of science more highly than his share in their discovery. His character was a rare combination of unassuming simplicity, honest candour, inflexible integrity, and native shrewdness. He had a keen sense of humour, which often served to enliven the driest discussions. In his private relations, goodness of heart rendered him one of the kindest and warmest of friends; while to those who had done him injury he was ever ready to extend that forgiving charity which suffereth long and is kind, and which thinketh no evil.

To our own Society the loss is heavier than can be expressed in words. In the hearts of those who have long known and esteemed him, affectionate memories will linger which time can never efface; while the work which he accomplished among us, as one of ourselves, will remain as an enduring memorial of the worker, an example of what may be attained by honest labour, a source of encouragement, and an inspiration of success.

Papers read before the Natural History Society of Glasgow.*

"The Colours of Crabs." [Read 27th November, 1855.]

"List of the Marine Crustaceans found in the West of Scotland." [Read 30th September, 1856.]

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* A full Bibliography, showing Mr. Robertson's other contributions to scientific literature in separate or joint authorship, up till 1891, is contained in *The Naturalist of Cumbrae*, pp. 385-390.

"On *Mytilus edulis*." [Read 25th November, 1856.]

"A Few Days' Dredging at Cumbrae." [Read 26th January, 1858.]

"Remarks on *Lima hians*." [Read 25th January, 1859.]

"Report on the Mortality amongst the Clyde Sea-fowl during the month of September last." [Read 29th November, 1859.] *Proceedings*, vol. i., p. 4.

"On the Marine Zoology and Botany of Loch Ryan, Bay of Luce, and Portpatrick, from Observations made during a recent Excursion." By Dr. John Grieve and Mr. David Robertson. [Read 25th March, 1862.] *l.c.*, pp. 21-36.

"Remarks on *Luidia fragilissima*," etc. [Read 29th April, 1862.] *l.c.*, pp. 36, 37.

"Remarks on *Hippolyte securifrons*, *Cuma trispinosa*," etc. [Read or spoken 26th January, 1864.] *l.c.*, pp. 82-84.

"On Clay Beds of Ross Arden, on the Banks of Loch Lomond." [Read 31st May, 1864.] *l.c.*, pp. 92, 93.

"An Account of a Visit to the Shores of Dunbar in February, 1864, with Descriptive Notes on the Natural History of the District." By Messrs. Robert Gray and David Robertson. [Read 26th April and 31st May, 1864.] *l.c.*, pp, 89, 90, 93, 94.

"Notes on *Corophium longicorne*, and on the Occurrence of *Alteutha bopyroides*." [Read 21st January, 1865.] *l.c.*, pp. 104-106.

"The Luminosity of the Sea." By Messrs. David Robertson and William Keddie. [Read 29th November, 1865.] Separately published.

"Notes on Specimens from Orme's Head." [Read 27th November, 1866.] *l.c.*, pp. 148-150.

"On Marine Dredging." [Read 28th May, 1867.] *l.c.*, pp. 179-183.

"On the Nudibranchiate Mollusca of the Shores of the Cumbraes." [Read 25th February, 1868.] *l.c.*, pp. 204-207.

"Notes on the Herring." [Read 26th January, 1869.] *l.c.*, pp. 240-247.

"Observations on a Mode of identifying certain Post-tertiary Fossils." [Read 28th September, 1869.] *Proceedings*, vol. ii., p. 3.

"Notes on *Cypris lævis*, and its habit of perforating the leaves of *Victoria regia*." [Read 28th December, 1869.] *l.c.*, pp. 7-10.

"On the Sea-Anemones of the Shores of the Cumbraes." [Read 27th March, 1870.] *l.c.*, pp. 24-30.

"On *Petromyzon fluviatilis*, and its mode of preying on *Coregonus clupeoides*." [Read 25th October, 1870.] *l.c.*, pp. 61-63.

"On the Reproduction of the Spines of *Echinus sphæra* (Müller)." [Read 29th April, 1873.] *l.c.*, pp. 217-219.

"Notes on a few of the Tube-building Annelids." [Read 30th November, 1875.] *Proceedings*, vol. iii., pp. 31-35.

"On Mounting Seaweeds." [Read 25th April, 1876.] *l.c.*, p. 85.

"On *Pisidium fontinale* and *Planorbis complanatus*, two Fresh-water Shells new to Scotland, and *Helix villosa*, a Land Shell new to Britain." [Read 27th February, 1877.] *l.c.*, pp. 172-175.

"On *Saxicava rugosa*, a Bivalve Mollusc; showing an unusual mode of repair." [Read 24th April, 1877.] *l.c.*, pp. 198-201.

"Fresh and Brackish-water Ostracoda" (in "The Fauna of Scotland, with special reference to Clydesdale and the Western District"). Published separately in 1880, and attached to *Proceedings*, vol. iv., part i. 35 pp.

"Remarks on a Few Hauls with the Dredge in Portree Bay, Skye." [Read 5th October, 1880.] *Proceedings*, vol. v., pp. 11-13.

"Note on *Astrorhiza limicola* and on *Amphidotus cordatus*." [Read 26th October, 1880.] *l.c.*, pp. 17-18.

"Notes on the Common Limpet." [Read 23rd March, 1884.] *Transactions*, vol. i. (New Series), pp. 9-20.

"*Talitrus locusta*, Linn." [Read 31st March, 1885.] *l.c.*, pp. 130-132.

"Notes on *Pedicellariæ*." [Read 28th April, 1885.] *l.c.*, pp. 132, 133.

"*Pagurus Prideauxii*, Leach." [Read 9th June, 1885.] *l.c.*, p. 290.

"*Amphidotus cordatus*, Penn." [Read 26th January, 1886.] *l.c.*, pp. 290-293.

"The Food of Fishes." [Read 22nd February, 1886.] *Transactions*, vol. ii., pp. 146-150.

"*Scaphander lignarius*, Linn." [Read 30th March, 1886.] *l.c.*, pp. 293, 294.

"*Purpura lapillus*, Linn." [Read 8th June, 1886.] *l.c.*, pp. 139-141.

"Observed Depths in Loch Lomond." [Read 3rd August, 1886.] *l.c.*, pp. 141-143.

"*Corystes Cassivelaunus*, Penn., and *Mytilus edulis*, Linn." [Read 30th November, 1886.] *l.c.*, pp. 143-146.

"A Contribution towards a Catalogue of the Amphipoda and Isopoda of the Firth of Clyde." [Read 26th April, 1887.] *l.c.*, pp. 9-99; also issued separately.

"On some Marine Mollusca." [Read 26th April, 1887.] *l.c.*, pp. 150-153.

"On the Local Distribution of *Pennatula phosphorea*, Linn., *Virgularia mirabilis*, Lam., and *Pavonaria quadrangularis*, Pall." [Read 7th June, 1887.] *l.c.*, pp. 211, 212.

"The Pike, *Esox lucius*, Linn., and *Isocardia cor*, Linn." [Read 16th August, 1887.] *l.c.*, pp. 212-215.

"*Hyas araneus*, Linn., and *Stenorhynchus longirostris*, Fabr." [Read 27th December, 1887.] *l.c.*, pp. 216-220.

"On some Differences between the Marine Faunas of the Firth of Clyde and Firth of Forth." [Read 28th February, 1888.] *l.c.*, pp. 220, 221.

"Loch Fyne Herring." [Read 27th November, 1888.] *Transactions*, vol. iii., pp. 22-24.

"Notice of Thirteen Cumacea from the Firth of Clyde." [Read 26th February, 1889.] *l.c.*, pp. 47-49.

"*Tubularia humilis*, Allman." [Read 29th October, 1889.] *l.c.*, p. 190.

"List of Foraminifera dredged in Portree Bay, Island of Skye." [Read 26th November, 1889.] *l.c.*, pp. 239-242.

"*Lagis Koreni*, Malagren." [Read 24th December, 1889.] *l.c.*, pp. 190-193.

"On some Recent Marine Ostracoda dredged in Granton Harbour." [Read 28th January, 1890.] *l.c.*, pp. 196-198.

"Habits of a Hedgehog (*Erinaceus europæus*) in Domestication." [Read 25th March, 1890.] *l.c.*, pp. 193-195.

"*Phycis blennoides* (Brün.)." [Read 29th April, 1890.] *l.c.*, p. 267.

"*Uraster glacialis*, Linn." [Read 30th September, 1890.] *l.c.*, pp. 269, 270.

"Notes on the Littoral Fauna of Kilchattan Bay, Bute." [Read 25th November, 1890.]

"A Second Contribution towards a Catalogue of the Amphipoda and Isopoda of the Firth of Clyde and West of Scotland."

[Read 31st March, 1891.] *l.c.*, pp. 199-223; also issued separately.

"*Pleurobranchus plumula*, Mont." [Read 29th September, 1891.] *l.c.*, pp. 268, 269.

"*Ascophyllum Mackaii* (Turn.) Holm. et Batt., forma *Robertsoni*, Batt." [Read 24th November, 1891.] *l.c.*, pp. 270, 271.

"*Zeugopterus punctatus*, Bl. (*Rhombus hirtus*, Yarrell)." [Read 23rd February, 1892.] *l.c.*, pp. 267, 268.

"*Sacculina carcini*, Thompson." [Read 27th December, 1892.] *Transactions*, vol. iv., p. 79.

"*Amphithoe podoceroides*, Rathke, and *Podocerus pulchellus*, Milne Edwards." [Read 27th March, 1893.] *l.c.*, pp. 80, 81.

"*Buccinum undatum*, Linn." [Read 20th June, 1893.] *l.c.*, pp. 81, 82.

"*Anceus maxillaris*, Montagu." [Read 22nd September, 1893.] *l.c.*, pp. 82, 83.

"*Aglaophenia myriophyllum*, Linn." [Read 23rd February, 1894.] *l.c.*, pp. 83, 84.

"*Bonnemaisonia asparagoides*, C. Ag., that gave a blue stain to paper." [Read 26th December, 1894.] *l.c.*, pp. 172, 173.

"*Halicystis ovalis* (Areschoug)." [Read 29th January, 1895.] *l.c.*, p. 174.

"The Gulls and their Neighbours." [Read 30th April, 1895.] *l.c.*, pp. 244, 245.

"On *Lima hians*, Gmel." [Read 23rd December, 1895.] *l.c.*, pp. 331, 332.

"On *Cancer pagurus* (Linn.)." [Read 31st March, 1896.] *l.c.*, pp. 332, 333.

"On *Amphidotus cordatus*, Penn." [Read 30th June, 1896.] *l.c.*, pp. 333, 334.

"A List of the Algæ of Lamlash Bay, Arran, collected during the month of September, 1894." [A posthumous contribution communicated by Mrs. Robertson, read 30th March, 1897.] *Transactions*, vol. v., pp. 62-71.

The Wild Birds' Protection Act of 1894, and the Future of British Oology.

By Colonel W. H. M. Duthie.

[Read 23rd February, 1897.]

It was natural that the Wild Birds' Protection Act of 1880 should be followed by further legislation with a view of protecting the eggs of certain species, for it was obviously futile to attempt to preserve our rare birds while at the same time their eggs were liable to be taken; so, in due time, the amended Act of 1894 was passed into law.

This Act empowers a Secretary of State, on application by a County Council, to prohibit the taking or destroying the eggs of any species of wild bird in any place within the county—forfeiture of the eggs, and the payment of a sum not exceeding one pound for every egg taken, is the penalty on conviction.

Up to the present date the Act has been taken advantage of by the County Councils of thirty-seven counties in England and Wales, and by a dozen in Scotland. Each of these counties has promulgated an order explaining the meaning of the Act, and clearly defining the manner in which it is to be carried out.

One or other of the four following plans has been adopted as a basis for framing these orders :—

(I.) A specified list of birds is given, the taking or destroying the eggs of which *in any part of the county* is prohibited.

(II.) A list of birds is given, the eggs of which are protected *within certain fixed limits.*

(III.) Certain areas are described, within which the taking of *all* wild birds' eggs is prohibited.

(IV.) A certain area is described, within which *all* wild birds' eggs are protected; and also a list is given of birds, the eggs of which are protected throughout *the entire county.*

The time during which the orders remain in force varies in different counties. In some, it is limited to a period of one, three, or five years, and is renewable; in others, no limit is given, the Act in such cases holding good till it is modified or repealed. On examination of the schedules, we find some of the lists of birds are made out with no great ornithological knowledge, while in others it is easy to trace the revising pen of an expert. All differ more or less with regard to the species selected for protection, according to the geographical position of the several counties and other local and traditional causes, but there are certain families and individuals which have a prominent position in all.

There is an almost unanimous opinion in favour of all species of Owls. In one county (Oxfordshire) the eggs of "the Owls" are alone protected. Eagles, Hawks, and Falcons are also well looked after, especially the Kestrel and Buzzards, which appear on nearly every list; but the Sparrow Hawk appears on none.

Among the Corvidæ, the Raven and Magpie have no friends in Scotland, but in England each can reckon on five counties willing to spare their eggs, while Midlothian and Haddington alone in Great Britain offer protection to the Jay. The Carrion and Hooded Crows and the Jackdaw receive no mention; the only sure refuge for these and other birds omitted from the lists is, therefore, within areas where the eggs of all birds are protected.

Such general favourites as the Skylark, Goldfinch, and Kingfisher, and all Warblers, also Woodpeckers and the Titmouse family, are made as safe as possible. In Scotland, several counties have inserted a separate clause for the protection of Lapwings' eggs after the 15th April in each year.

We are glad to miss none of our rare and local nesting birds on those lists in which we expect to find them, such as the Chough, the Golden Oriole, the Kite, and the Kentish Plover; and, in addition, we notice that several vagrant visitors, which formerly nested with us, are promised a welcome should they care to do so again. Eggs of the Great Bustard were taken in the neighbourhood of Thetford within the last sixty years, and Suffolk, bearing

the fact in mind, has placed the name of that fine bird upon its county list. The Bittern, if allowed to live, would breed in some of the preserved sanctuaries which suit its tastes; also the Ruff; both of these birds are offered protection for their eggs by the counties which they visit.

Among the names of rare birds mentioned in the Shetland schedule are included those of the Great Northern Diver, Sea Eagle, and Whimbrel. The County of London is ambitious, and shows its love for birds in presenting a long list, in which the Osprey, Honey Buzzard, and Bearded Titmouse appear in company with other species which it would be curious to find nesting in Kensington Gardens or in Grosvenor Square.

Elgin is hopeful, offering protection for the eggs of the Whooper and Bewick's Swans.

The information contained in the schedules already published is a sufficient indication of the drift of public opinion, and it enables us to forecast what will be the result when all the counties of the Kingdom combine to give a nesting sanctuary to the birds.

Unless the Act is universally adopted, its object cannot be attained. Partial protection is worse than useless, for egg collectors, especially those whose collections are nearly complete, will invade the localities which have failed to take advantage of the Act, and British specimens acquired surreptitiously on preserved ground may be labelled as taken in counties where the law is not in force. Probably the very fear of intrusion will be the cause of all counties, sooner or later, partaking of the protection which the Act affords.

It is thought by some that the Act will be inefficient, that things will go on much as before, and that *egg stealers* will run their chance of conviction. We do not share that opinion, for poachers never willingly show their spoils, and there is no pride in exhibiting ill-gotten gains; and besides, there is the Society for the Preservation of Birds to deal with. This Society was formed in 1889, "called into existence," as stated in its circulars, "by the pitiless destruction which has for long past been carried on all over the world, hundreds of thousands of birds being sacrificed yearly, especially during the nesting season, to supply the demands of a barbarous fashion in dress and decoration." Founded in its infancy for a special object, the Society is

extending its scope, and is interested in all methods adopted for the preservation of the feathered race. It is now a strong and well-organised body, having many well-known ornithologists on its committee. It has branches all over the Kingdom, and is sowing its educational leaflets broadcast throughout the land.

Much as we rejoice at the bright prospect which is opening up for the birds, and at the defeat of the greedy and mercenary egg collectors, by whose action the new legislation has been rendered necessary, we cannot refrain from sympathising with the *bona-fide* naturalist, whose collection is the fruit of earnest study, and to whom the contents of his cabinets are not merely an accumulation of items measured by quantity or by price, but are valuable contributions to his own practical knowledge and experience, records of hard work accomplished, results of many a carefully-planned expedition, representing to him, as do the rows of stags' heads in the Highland shooting lodge to the stalker, trophies of victories gained over wild nature and self.

Bird-nesting, if judiciously carried out, is a sport in every sense of the word, and all the best qualities of a good sportsman are required in a successful bird-nester—patience, endurance, courage a sharp eye and sensitive ear to detect the slightest movement or faintest sound, and, above all, the *instinct* of keen observation.

The effect of the Act will be keenly felt by our schoolboys. To many of these, bird-nesting becomes a passion, partly on account of a certain spice of danger which often accompanies it, for, besides the feat of climbing a difficult tree, or the sensation of hanging in mid-air from the top of a high cliff, there are the minor excitements which are attractive, such as the risk of being caught out of bounds, the fun of outwitting an irate farmer, and the agonising suspense of waiting concealed in a wet ditch until the gamekeeper and his dog are out of sight.

The spirit of emulation runs high at school, and the possessor of certain rare eggs occupies an envied place in the ranks of youthful oologists.

All ornithologists of note, and probably most naturalists, were bird-nesters in their youth, and it was in those early days that the germs of acute observation were developed, and the habit of accurately noting down facts was acquired.

All this will now be changed. The eggs of the rarest British

birds being practically preserved, the interest of collecting will cease, and the oologist of the future must go elsewhere for his specimens, and look for other means for recording his home work. He will find in photography a ready helpmate, as a glance at some of the numerous books on British Birds' Nests and Eggs just published will show. Before these books were printed, many lovers of birds had been quietly working on these lines, and from personal experience we can testify to the enjoyment and interest which is to be found in bird-nesting with a camera.

Wandering at will over moorland and mountain, through forest and by stream, along the calm lake shore and on wild ocean's rim, we can search out the nesting haunts of the birds, and bring back pictures of their nests with all their varied surroundings, we can depict the eggs and young, and sometimes even the sitting birds themselves may be portrayed. Excellent as are some of the photographs already obtained, there is much room for improvement. The difficulty of obtaining good results is exceptionally great, owing to the cramped and limited conditions under which the pictures have so often to be taken; but it must be borne in mind that one occasional success in a life-subject, the opportunity of even seeing which may never occur again, is ample compensation for many and many a failure.

[This paper was followed by an exhibition of lantern-slides illustrating British Birds' Nests.—See the account of the Society's Proceedings, under date 23rd February, 1897.]

The Distribution of the Chiff-chaff (*Phylloscopus rufus* (Bechst.)), in the Clyde Area. By John Paterson.

[Read 29th June, 1897.]

The status of the Chiff-chaff, as a Clyde species, does not appear to be at all understood by British ornithologists. This is not surprising when we bear in mind that the chief, indeed the only, source of information on this subject has hitherto been Gray's *The Birds of the West of Scotland, &c.*, published in this city twenty-six years ago. In that work the student of the distribution of avian life in the Clyde area gets so little information that we can repeat it here in full. "It is not uncommon," Gray says (*loc. cit.*, p. 98), "in roadside plantations near Glasgow, and a few also visit the district of Lochlomond." Further on it is stated —"Mr. Anderson has procured specimens at Girvan, in Ayrshire." This completes the information supplied for the great natural area draining into the Clyde and its Firth.

Treating the distribution topographically, and proceeding from South to North, we begin in the South of Ayrshire.

Ayrshire.—At Glen App Mr. H. B. Watt found it of frequent occurrence (April, 1895). Mr. Charles Berry, of Lendalfoot, has shown me eggs of this species taken in his district, and he informs me that it is quite common in the valley of the Stinchar. It occurs near the Ayrshire boundary, on the Feoch Burn, a tributary of the Duisk, which runs into the Stinchar, as I am informed by Mr. John Robertson (April, 1895).

In the valley of the Girvan Water it is of frequent occurrence. When walking down this valley in June, 1896, with Mr. Robertson, we heard it at Blairquhan, near Straiton, and at two points on the road between Dailly and Killochan Station. At Killochan House I have known it to occur for a number of years. "Girvan" is one of the localities named by Gray.

On the Doon Water I have heard it at Doonfoot and Cambusdoon* (*Annals of the Andersonian Nat. Soc.*, Vol. II., pt. 1, p. 32). Mr. J. Robertson visited the Doon, below Auchendrane, at my suggestion, on 26th March, 1894, and reported its occurrence in four localities as the result of his day's observation.

On the Water of Ayr it was noted at an excursion of the Andersonian Naturalists' Society to Auchincruive in April this year, and it was heard on the Coyle Water on the same occasion. It had been reported to me the previous year by Mr. Wm. Adam, Jun., from a locality a few miles from Ayr.

In the Irvine Valley it occurs as far up as Lanfine estate, near Darvel, as I learn from Mr. Robert Wilson; and Mr. John Robertson reported its occurrence at Dundonald Glen some years ago, where, in his company, I have since heard it.

In a list of birds of the Parish of Beith, by Messrs. Matthew Barr and John Craig, it is included as a nesting species.

The Rev. David Landsborough, of Kilmarnock, informs me that about 1840 the Chiff-chaff nested in his father's manse garden at Stevenston. Mr. Landsborough says it appeared to get frequent at that time.†

Renfrewshire.—Taking up the record at Lochwinnoch, on the Ayrshire boundary, we find that in this parish it is a familiar bird, as mentioned in these *Transactions* (Vol. IV., N.S., p. 363), some seven males being heard in the course of a Saturday afternoon's ramble in Castle Semple grounds, and it occurs in the Skiff Wood, above Howwood, in the same parish. Mr. John Lang, of Greenock, has reported it to occur at Duchall, near Kilmalcolm. The late Mr. Morris Young, of the Paisley Museum, told me that it was formerly not uncommon in a wood at Rushylie, two miles east of Erskine Ferry, and that he had taken its nest and eggs there.

In the political division known as East Renfrewshire, a list of the birds of which, by Mr. John Robertson and the writer,

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* Mr. J. Robertson has reminded me that on the date we visited Cambusdoon he heard it at Newark Castle in that neighbourhood.

† In passing through Eglinton Castle grounds a few days after reading this paper, I heard the Chiff-chaff calling at five places. The weather, it should be stated, was blustering and unfavourable for successful observation.

appeared in the *Annals of Scottish Natural History*, October, 1895, we have never been able to trace its presence until the present year, when it has turned up in two localities. The first locality, at Giffnock, is a small wood, which has been thoroughly investigated for many years each nesting season, and we are quite certain that its occurrence there this year, where Mr. Robertson has found its nest on a clump of honeysuckle eighteen inches from the ground, points to an extension of its range. The second locality is at Giffnock also, about half-a-mile distant from the first.

Buteshire.—The Chiff-chaff appears to have been first recorded for Arran by Mr. Wm. Evans in 1895 (*Annals of Scottish Natural History*, p. 195), and it was heard in the following year by some of the members of this Society who visited Goatfell in May, as mentioned in these *Transactions* (Vol. IV., N.S., p. 365).

Dr. Niel Fullarton, of Lamlash, sends me the following valuable note on this species:—"The Chiff-chaff I have noticed yearly for upwards of thirty years. It is distributed all over the east side of the island, from Lagg to Brodick. In the woods above Lagg I saw it . . . first last year. Nearly every season since I have settled here [Lamlash] (1877), I have come across its nest in some part of the district above-mentioned."

In Bute, I am informed by Mr. John Orr of this Society, it occurs in the wood south of Kilchattan Bay.

Argyllshire.—At excursions of this Society in 1895 to Castle Toward and Benmore estates, as recorded in these *Transactions* (Vol. IV., N.S., pp. 368, 369), I heard a single bird calling in each case.

Dumbartonshire.—At an excursion of the Ornithological Section of the Andersonian Naturalists' Society to Rosneath (April, 1895), some four males were heard calling. Mr. James Lumsden says of it, in *A Guide to the Natural History of Loch Lomond and Neighbourhood* (1895), that it is "not a common bird in any part of the district." It is mentioned as occurring at Camis Eskan, near Helensburgh, in the report of the visit of the Andersonian Naturalists' Society to that place (20th April, 1895).

STIRLINGSHIRE.—The only locality in this county (in the part belonging to "Clyde") that I know of its occurrence in, is Garrel Glen, Kilsyth, where I saw and heard it in May, 1891.

LANARKSHIRE.—As a Lanarkshire species, scarcely anything can be said about it. Mr. James S. Dixon, in a letter addressed to the *Glasgow Herald*, dated from Bothwell, May 29, 1895, mentions it. "At present, at least half-a-dozen pairs [of Garden-warblers] are nesting in a wood [near Bothwell] formerly much frequented by the Chiff-chaff and Wood-wren, this season till now conspicuous by their absence." When I asked Mr. Dixon regarding his knowledge of the Chiff-chaff's occurrence at the locality in question, he qualified the statement above quoted by saying that the Chiff-chaff was always a rare bird, much rarer than the Wood-wren.

Mr. Dale, gardener at Aikenhead, on the western boundary, has heard it there, but not regularly; and Mr. Joe Christie tells me he has heard it two or three miles east of Aikenhead.

The facts above stated call for some remarks. The record, though marking a great advance in our knowledge of the distribution of this species in the Clyde area, is still far from complete. Kintyre, Lochfyneside, the Island of Bute, and the Cowal district of Argyllshire, are yet to investigate. What may at first sight appear a curious fact is that when we go westwards, and especially south-westwards, from Glasgow to a wooded locality, we look confidently for the Chiff-chaff, and are seldom disappointed. When we go eastwards from the same centre, up the Clyde Valley, we do not expect to find it. Without claiming a satisfactory knowledge of the distribution of some of the warblers in "Clyde," east of Glasgow, I still know sufficient regarding the summer bird-life of that region to justify the opinion that it must be at least very uncommon. Many excursions to the Clyde between Glasgow and Uddingston, to Bothwell Castle, Blantyre Priory, Hamilton Palace, Cadzow, Dalzell, the orchard country, Lanark, and Douglasdale, have failed to yield a single instance of the occurrence of this species. The gentlemen who are associated with me in investigating the birds of the "Clyde area" have been similarly unfortunate in their excursions eastwards from Glasgow. Gray's statement above quoted (*ante* p. 48), that

"it is not uncommon in roadside plantations near Glasgow," is entirely unconfirmed. In Mr. Henry C. Young's "List of Birds which breed in the Vicinity of Glasgow," in the *Notes on the Fauna and Flora of the West of Scotland* (Glasgow, 1876), the only statement regarding the occurrence of the Chiff-chaff is that just quoted from Gray. The statement in Gray's article on "The Birds of Glasgow and its Vicinity," in the publication last named, that the "Chiff-chaff is moderately common in hedges a short distance westwards from the Botanic Gardens," however categorical, is a curious one.

Referring to the occurrence of this species in the districts bordering on the Clyde area, we know it to abound at Castle Kennedy, WIGTOWNSHIRE (*Report, Excursion Andersonian Naturalists' Society*, 20th May, 1897). In KIRKCUDBRIGHTSHIRE it is "everywhere scarce and local" (Robert Service, *The Vertebrate Zoology of Kirkcudbrightshire*, 1896). In DUMFRIESSHIRE Mr. Service informs me that he thinks it is scarcer than in Galloway.

In the area drained by the Forth, Mr. Evans tells me he knows of it "as a regular summer visitor to the extreme east and extreme west" (7th August, 1896).

In Messrs. Harvie-Brown and Buckley's *Vertebrate Fauna of Argyll and the Inner Hebrides* (1892) it is excluded.

Summarising its distribution in "Clyde," it is, as far as we know at present, most numerous in the west of the area, and especially so in the south-west. This agrees with its abundance in Wigtownshire (Solway area) at Castle Kennedy, as recently announced. East of Glasgow it appears to be rare, and this agrees with its small numbers in Dumfriesshire and Kirkcudbrightshire. It is interesting, in connection with its distribution in the area under review, to bear in mind that it breeds in every Irish county, and, while scarce in some eastern English counties, Norfolk for instance, it is numerous in the south and south-west, especially in Somersetshire and Devonshire.

On Bipalium kewense, Moseley. By Charles Hogg.

[Read 29th December, 1896.]

Bipalium kewense, Moseley, is a land planarian of foreign origin. It was first discovered in 1865 at the Botanic Gardens, Giessen, and again in a hothouse at Kew, and described in the year 1878 by Professor Moseley, F.R.S. (*Annals and Magazine of Natural History*, vol. i., Fifth Series, p. 237). The following is the description :—

"Body slightly rounded above, flat beneath, slightly narrower just behind the head, and tapering very gradually posteriorly, to terminate in a long and slender hinder extremity; with a narrow but well-marked ambulacral line. Lunate head of moderate size, about twice as broad as the part of the body immediately behind it. General colour of the body light ochre-yellow above; beneath very pale, almost white. Five dark violet stripes, a mesial and two pairs of lateral, extending along the entire length of the dorsal surface. The mesial stripe narrow and linear, the succeeding pair broad and band-like, and the outermost pair again linear. The outermost pair placed at a short distance from the lateral margin of the upper surface, and the band-like pair at half the distance between these and the central stripe. Just behind the head the two lateral bands on either side fuse together, and form a pair of broad dark patches." "Faint and narrow violet stripes mark the margin of the ambulacral line on the under surface of the body.

"Length of single specimen, 9 inches; extreme breadth of the body, $\frac{1}{7}$ inch; of the head, $\frac{1}{5}$ inch."

Dr. Albert Günther, of the British Museum, refers in the *Gardener's Chronicle* to a specimen obtained at Welbeck Gardens in 1883; and again reference is made to this species in the same journal by Mr. F. Jeffrey Bell in 1886 as appearing at Fernhurst, Haslemere, and at Clapham Park.

Nothing of the habits of this species is known, nor even its original home. It is generally understood to have been introduced with plants from abroad. Specimens have generally been found in hothouses of low temperature, and Professor Moseley, basing on temperature, suggests Japan or China as the country of its origin.

The specimens which I have the pleasure to place before you were taken at Woodside Gardens, Paisley, where this species has been noticed less or more plentifully during the last three or four years. This, I believe, is the first record of its appearance in Scotland.

I have been able to take the following observations, hitherto unrecorded, regarding this species:—It is of nocturnal habits; any captures that are made during the day seem to be of animals in a dormant condition, as they are curled up in what seems a resting position. Hitherto heat has been looked upon as essential to its existence, but that is not, or at least does not seem, necessary, as specimens have been taken in an open border when the ground was frost-bound and the temperature considerably below freezing point. At the same time they are generally taken in a house the temperature of which ranges between 40° and 45° Fahr. They are not injurious to plants as far as known, and are lovers of moist places. It is certain, I believe, that they breed at Woodside, specimens having been taken from two inches upwards, but as yet I have been unable to gather any particulars regarding their food or the production of their young.

With regard to the original home of this species, I may state that a large consignment of plants was received direct from Algiers in the year 1890—previous to the appearance of this planarian. One, if not more, of the places recorded in England received plants from Kew, and it is thought that it may have been transferred with these consignments; but that is not the case with the Scottish record, no plants having been received from that source.

On Some Coll and Tiree Plants.

By Symers M. Macvicar.

[Read 29th December, 1896.]

In vol. iv., part 2 (pp. 226-230), of the *Proceedings* of this Society, there is an interesting paper on a visit to Coll in 1879 by Mr. Thomas Scott, now Naturalist to the Fishery Board for Scotland. In addition to giving an account of the island, several plants are mentioned, most of which I also saw there during a visit last summer. The species of Papaver queried in the paper are *Papaver dubium*, Linn., and *P. Argemone*, Linn. The species of Utricularia are, as Mr. Scott thought they might be, *Utricularia minor*, Linn., and *U. intermedia*, Hayne. Cladium is still in the loch mentioned, and also grows in another loch about two miles distant. *Festuca rottbœllioides*, Kunth, does not now grow on the old castle where Mr. Scott found it, but I saw it in another locality. The more interesting plants seen during my visit were *Ranunculus Baudotii*, Godr., *Draba incana*, Linn., a small form growing on sand dunes, as it does in West Sutherland and on the west coast of Ireland; *Viola Curtisii*, Forster, *Anthyllis Vulneraria*, Linn., var. *maritima*, Koch, *Erythræa Centaurium*, Pers., var. *capitata*, Koch, *Melampyrum pratense*, Linn., var. *hians*, Druce, *Atriplex laciniata*, Linn., *Orchis pyramidalis*, Linn., *O. incarnata*, Linn., *Scilla verna*, Huds., *Potamogeton coloratus*, Hornem. (=*P. plantagineus*, Du Croz). The Rubi observed were *Rubus plicatus*, W.&N., *R. dumnoniensis*, Bab., *R. villicaulis* (sp. collect.), var. *Selmeri* (Lindeb.), and *R. danicus*, Focke. Specimens of these were named or verified by the Rev. W. Moyle Rogers, F.L.S. A few Hazel, Oak, and Rowan trees, or rather bushes, occur, all being prostrate; also a few Aspens on the faces of cliffs. The only erect indigenous trees seen were two specimens of *Betula pubescens*, Ehrh. It is an interesting coincidence that this species, which has become extinct in the island of Eigg within the last fifty years or so, was for many of its last years limited also to two erect trees. *Salix aurita*, Linn.,

and *S. repens*, Linn., are not uncommon in Coll; the former is apparently absent from Tiree. *Juniperus communis*, Linn., *forma*, is locally in abundance as a prostrate plant.

Tiree is more flat than Coll, and, having no shelter, there is a complete absence of trees and gardens. No Rubi could be seen, and only three dwarf bushes of *Rosa canina*, Linn., clinging to the face of a rock, were met with. Some interesting plants noticed were *Ranunculus Drouetii*, Godr., *R. Baudotii*, Godr., *R. marinus*, Fries, the first "satisfactory" specimens of Fries's plant which Mr. Arthur Bennett, F.L.S., to whom I submitted them, has seen from Scotland; *Hippuris vulgaris*, Linn., var. *fluviatilis*, Weber, with shorter leaves than usual; *Apium nodiflorum*, Reichb. fil., var. *ocreatum*, Bab., *A. inundatum*, Reichb. fil., *Sium erectum*, Huds., *Œnanthe Lachenalii*, C. Gmel., *Plantago Coronopus*, Linn., var. *maritima*, Grenier & Godr., a distinct plant, with broad thick fleshy leaves. Mr. Arthur Bennett identified this plant, which is given in *Flore de la France*, vol. ii., 1850. It has not been hitherto recorded from Britain, I believe. *Alisma Plantago-aquatica*, Linn., var. *lanceolatum*, Afz., *Potamogeton nitens*, Web., *P. filiformis*, Nolte, *Carex disticha*, Huds., *C. flava*, Linn., var. *cyperoides*, Marsson, this variety being more common than the type, *Deschampsia discolor*, R. & S.; *Festuca rottbœllioides*, Kunth, is locally common. *Equisetum palustre*, Linn., var. *nudum*, Newm., occurs on the sandy shore of Loch Vassapol. The Characeæ gathered were, from Tiree—*Chara fragilis*, Desv., and *C. fragilis*, Desv., var. *delicatula*, Braun, *C. aspera*, Willd., *C. contraria*, Kuetz., *C. vulgaris*, Linn., and *C. vulgaris*, Linn., var. *papillata*, Wallr., *Nitella translucens*, Agardh, and *N. opaca*, Agardh. From Coll—*C. fragilis*, Desv., var. *delicatula*, Braun, *C. aspera*, Willd., var. *subinermis*, Kuetz., and a form approaching *C. aspera*, Willd., var. *curta*, Braun, *C. hispida*, Linn., and *C. vulgaris*, Linn. Messrs. H. and J. Groves, F.L.S., kindly named nearly all the above. I am much indebted to our Corresponding Member, Mr. Arthur Bennett, F.L.S., for having examined several bundles of plants sent to him from both islands. Of the 357 species and varieties noticed, there were upwards of 40 species which had not been recorded for vice-county 103, in which these islands are included. The Characeæ, with the exception of *Chara fragilis*, Desv., were, I think, new to the vice-county.

The distribution of aquatic plants on our west coast is a subject of much interest, and there is much to be done in this direction. Few Batrachian Ranunculi appear to have been recorded from between the Clyde and the vice-counties 103 and 110. Also with some species of Potamogeton and with Characeæ, the same blank occurs, yet some of these plants most probably occur in intermediate localities. Dragging apparatus does not take up much room, and it is much to be wished that our lochs were explored as occasion offers. As far as I have seen, small, easily-worked lochs are as productive as large ones, and in the latter, one of the best places is also the part most easily worked—that is, near the exit of the loch and a short distance down the outgoing stream.

On the Grasping Power of Carboniferous Crinoid "Fingers" or "Branches," and a Speculation as to whether the Bulk of the Carboniferous Crinoidea were Fixed or Floating Animals.

By John Smith, Corresponding Member.

[Read 25th May, 1897.]

It is now more than twenty years since I collected, at Westerhouse, near Carluke, Lanarkshire, specimens showing parts of two Crinoid "fingers" or "branches," *twisted tightly round the stems of other Crinoids*, or perhaps round those to which the fingers belonged. Since then I have examined a considerable quantity of shale from various places, both in Carboniferous and Silurian districts, but it was only within the last twelve months that I obtained further examples of the grasping Crinoid remains.

At Auchenskeith, Dalry Parish, Ayrshire, there is a bank of shale, about the centre of the quarry, with a considerable quantity of Crinoid debris exposed on it, and from it—by washing a large amount of the shale—I obtained a few examples. This Crinoid shale has come from the "upper post" of the *Lower Limestone Series*, which here is pretty much cut up by interlaminated beds of fossiliferous shale, the section varying considerably along the exposed part of the quarry.

Opposite the spoil bank where the grasping Crinoid remains most frequently occur, the section of this limestone is as follows:—

Fossiliferous shale with much Crinoid debris,	4 feet.
Crinoid shale with 3 bands of Crinoidal limestone,	4 „
Shale with many small Corals, and 1 band of limestone with Corals,	2 „
Limestone with 8 thin bands of shale,	4 „
Limestone with 9 partings of shale,	4½ „
(Alum Shale.)	

All the limestone is very full of fossils, some bands of it being made up of scalps of *Streptorhynchus crenistria*, Phill., Crinoid remains, or Producti, mostly *Productus semireticulatus*, Martin.

The shale on the Crinoid shale bank evidently came from the upper eight feet of the section, and, although Crinoid remains much prevail, it also contains small Corals, Producti, *Spirifera Urii*, Flem., *Chonetes polita*, M'Coy, frequently; and rarely, small Conularias, &c.

I asked Mr. James Bennie, of the Geological Survey, who has perhaps examined as much shale as any one, if he had ever found any of these grasping "Crinoid fingers" or "branches." He replied that he had not, but had often got the "grasping feet" of Crinoids. Of course, any person who has been in the habit of examining fossiliferous shale—either Silurian or Carboniferous—must be well acquainted with these "grasping feet," as Mr. Bennie calls them. In our Scotch Carboniferous shales *they are always found in connection with very small, or perhaps young Crinoids*, and are the *processes* by which the *base* of the *column* was fixed to foreign bodies, generally fragments of shells, Crinoid "stems," or Corals; the large Scotch Carboniferous specimens *never showing rooting processes*. This leads me to think—and I have long held the opinion—that our large Carboniferous Crinoid "stems," or "columns," were *not attached* by root-like processes, or by a calcareous plaster, resembling that which fixes *Corallina officinalis*, Linn., a calcareous seaweed, to stones; but were *free-swimmers*, like jelly-fish, *the "stem" hanging down in the water, and so preserving them in a vertical position*. The base may have been fleshy, and they may, of course, have been fixed after the manner of an Anemone, and if so, we are not likely to find this out.

The great weight of the column is rather against the floating theory, but still it is the most plausible I can think of. It is not likely that the stems lay along the sea bottom, as in that case we ought to find them oftener in considerable lengths; but the fact is they are nearly always got in short bits, often indeed broken up into their ultimate joints; and had they lived prone on the sea bottom, the stems ought to be curved near the base of the calyx. The "branches" are often found to be *curved* close to the stems. From this consideration, the upright theory of growth is

certainly the most plausible, but we are not likely ever to know whether they were fixed to the sea bottom, or on substances lying on it, in some way, or were free-swimmers: if the last, then they must have been furnished with some kind of special float.

All the recent Crinoidea, or their close allies, are—so far as I know—fixed by a calcareous cement.

The Bradford Pear Crinoid, *Apiocrinus Parkinsoni*, Schloth, has strong calcareous "roots," and I have collected specimens of moderate size from the Wenlock formation showing the bases of the stems attached to Corals. (See figure c.)

The specimens I have found at Auchenskeith and Westerhouse show the fingers or branches twisted once, twice, and three times round the stems of other Crinoids—all the examples being very small. One of them shows that the stem of attachment had continued to grow, and the finger or branch to grasp it, till the stem died; for it had swollen round the sides of the finger as a growing tree does with fencing wire fixed round it.

The species to which the grasping arms or fingers belonged appears to be a very small smooth variety, the "cups" of which are got in the shale along with them.

Mr. Bennie was also good enough to look up for me the "Challenger" monograph on the Crinoids, but could find no reference to a grasping power in any of those dredged by that expedition, and figured and described in the monograph.

I asked Mr. Thomas Scott, F.L.S., of the Marine Station, Granton, if he could tell me if any of the recent Crinoidea have the power of catching hold with their "fingers," and he replied that—"The habits of Antedons (Echinoderms) lead me to believe that they can grasp suitable objects with their flexible arms; as a matter of fact, it is often difficult to disengage them from amongst zoophites, owing to this very habit."

Since Mr. Scott's attention has been drawn to this matter, we will be sure to have more definite information regarding it by-and-bye. What we want to know is whether any recent Crinoidea can twist their arms *tightly* round a hard object, like a bit of brass wire twisted round a pen stick, the tendrils of some plants, or the prehensile tails of certain animals.

Some of the Carboniferous Crinoid bases or "rooting" processes are *twisted round* stems of Crinoids (figure B), but they are gener-

ally fixed by a plaster-like cement with root-like processes round the edges, which are sometimes seen to form a rough network.

From my specimens it cannot be said with certainty whether or not they indicate that it was the "fingers" which sprung from the top of the calyx (and by the aid of which the animal fed itself), or the jointed "branches" which grew from the sides of the column, or both, that had the grasping power.

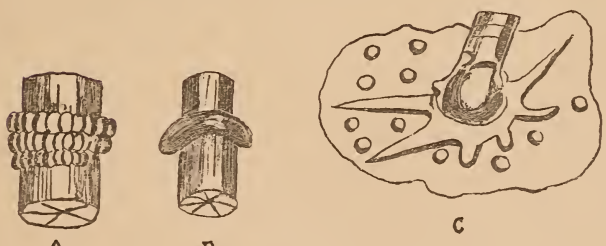
Specimens Exhibited.

1. Crinoid "fingers" or "branches" twisted round the stems of Crinoids.
2. "Rootlets" of a Silurian Crinoid.
3. *Corallina officinalis*, Linn., showing the calcareous plaster with which it is fixed to stones.
4. "Cups" of the Crinoids to which the grasping "fingers" probably belonged.
5. Bases of young Carboniferous Crinoids.

Figure A. Part of Crinoid "finger" or "branch" twisted three times round a Crinoid stem. Carboniferous.

B. Crinoid "root" twisted round Crinoid stem. Carboniferous.

C. Base of Crinoid stem fixed by "rooting" processes to a Sun Coral. Silurian.



A List of the Algæ of Lamlash Bay, Arran, collected during September, 1894.

By David Robertson, LL.D., F.L.S., F.G.S.

[A Posthumous Paper, communicated by Mrs. Robertson, and read 30th March, 1897.]

Lamlash Bay is about three miles long in a line from Clauchlands Point to King's Cross Point, intersecting a small portion of the Holy Isle. The widest part is from a little south of the village to the nearest point of the Holy Isle. The bay narrows at the north channel to a little more than three-quarters of a mile in a line between Clauchlands Point and the Holy Isle, and the souths channel to about one-third of a mile between King's Cross Point and the Lighthouse. The greatest depth is twenty-four fathoms a little northward of St. Molios's Cave, and the bay is deeper on an average towards the south channel than towards the north.

The appearance of the shores of Lamlash Bay does not present much inducement to the marine botanist. They are mostly bare, or with boulders covered here and there with coarse Algæ. Few seaweeds are washed up on the beach, promising little of what may be had off-shore. The tide pools along the shore are mostly flat, and do not yield much along to Claughland Point. Round the point, towards Brodick, the pools are deeper and more sheltered from the sun, and yield a fair variety of the less common species. It may be worth while spending a little time among the pools on Hamilton Rock, where *Codium tomentosum*, Stackh., was met with in fine condition.

The water for some little distance off the shore, from the village along to near Claughland Point, is shallow and sandy. At many places a little beyond low-water large beds of Zostera are laid bare or brought into view at the surface, and they generally yield a variety of parasitic species, as well as others which seem to nestle among the roots of this plant. Our best results with the dredge

were towards the north channel, in seven to twelve fathoms. A number of species was met, more or less rare, including *Dudresnaya coccinea*, Bonnem., *Scinaia furcellata*, Bivona, *Bonnemaisonia asparagoides*, Ag., *Lithothamnion coralloides*, Crn., var. *subsimplex*, Batters, nov. var., *Halicystis ovalis*, Areschoug. This species was obtained moderately common adhering to *Lithothamnion coralloides*, Crn., var. *subsimplex*, Batters, at a depth of seven to eight fathoms. So far as I am aware, this Alga is new to Britain, with the exception of one or two specimens dredged in from eight to nine fathoms by Dr. Murray about two years ago in Kilbrannan Sound, in company with the late Professor Schmitz and Mr. George Murray of the British Museum.

My thanks are due to Mr. E. A. L. Batters, LL.D., B.A., F.L.S., &c., for his kind assistance. He has examined all doubtful species.

SERIES CYANOPHYCEÆ.

Order Rivulariaceæ.

Calothrix, C. Ag.

C. confervicola, C. Ag.

Rivularia, J. Ag.

R. atra, Roth.

SERIES CHLOROPHYCEÆ.

Order Ulvaceæ.

Enteromorpha, Link.

E. clathrata, J. Ag.

E. compressa, Grev.

E. intestinalis, Link.

Ulva, Linn.

U. lactuca, Le Jol. (= *latissima*, Phyc. Brit.).

Order Cladophoraceæ.

Urospora, Aresch.

U. isogona, Batt. (= *Conferva Youngana*, Phyc. Brit.).

Ulothrix, Kütz.

U. flacca, Thur. (= *Lyngbya flacca*, Phyc. Brit.).

Chætomorpha, Kütz.

C. melagonium, Kütz. (= *Conferva melagonium*, Phyc. Brit.).

C. ærea, Kütz. (= *Conferva ærea*, Phyc. Brit.).

C. tortuosum, Kütz.

Cladophora, Kütz.
C. utriculosa, Kütz.
C. rupestris, Kütz.
C. arcta, Kütz.

ORDER CODIACEÆ.

Codium, Stackh.
C. tomentosum, Stackh.

ORDER VALONIACEÆ.

Halicystis.
H. ovalis, Aresch.

SERIES PHÆOPHYCEÆ.

COHORT ECTOCARPINÆ.

ORDER DESMARESTIACEÆ.

Desmarestia, Lamx.
D. aculeata, Lamx.
D. viridis, Lamx.

ORDER DICTYOSIPHONACEÆ.

Dictyosiphon, Grev.
D. fœniculaceus, Grev.
D. hippuroides, Kütz.

ORDER PUNCTARIACEÆ.

Litosiphon, Harv.
L. pusillus, Harv.
L. Laminariæ, Harv.

ORDER ASPEROCOCCACEÆ.

Asperococcus, Lamx.
A. bullosus, Lamx. (= *A. Turneri*, Phyc. Brit.).

ORDER ECTOCARPACEÆ.

Ectocarpus, Lyngb.
E. terminalis, Kütz.
E. simplex, Crn.
E. pusillus, Harv.
E. globifer, Kütz.
E. confervoides, Le Jol.
E. elegans, Thur.

E. fasciculatus, Harv.
E. granulosus, C. Ag.
E. tomentosus, Lyngb.
E. ovatus, Kjellm.
E. crinitus, Carm.
E. Landsburgii, Harv.
E. distortus, Harv.
Pylaiella, Bory.
P. litoralis, Kjellm. (= *Ectocarpus litoralis*, Phyc. Brit.).
P. litoralis, Kjellm., f. *ferruginea*, Kjellm.

ORDER ELACHISTACEÆ.

Elachista, Duby.
E. fucicola, Fries.
Myriactis, Kütz.
M. stellulata, Batt.

ORDER SPHACELARIACEÆ.

Sphacelaria, Lyngb.
S. olivacea, Pringsh.
S. cirrhosa, C. Ag.
S. cirrhosa, C. Ag., f. *fusca*, Holm. & Batt.
Chætopteris, Kütz.
C. plumosa, Kütz. (= *Cladostephus plumosus*, Holm. Fasc. No. 1).
Cladostephus, C. Ag.
C. spongiosus, C. Ag.

ORDER MYRIONEMIACEÆ.

Ralfsia, Berk.
R. clavata, Crn.

ORDER CHORDARIACEÆ.

Spermatochnus, Kütz.
S. paradoxus, Rke. (= *Stilophora Lyngbyei*, Phyc. Brit.).
Stilophora, J. Ag.
S. rhizoides, J. Ag.
Chordaria, C. Ag.
C. flagelliformis, C. Ag.
Mesoglœa, C. Ag.
M. vermiculata, Le Jol.
M. lanosa, Crn.

Castagnea, Derb. et Sol.

C. virescens, Thur. (= *Mesoglœa virescens*, Phyc. Brit.).

C. Zosterœ, Thur. (= *Mesoglœa virescens*, β, *zostericola*, Phyc. Brit.).

Leathesia, J. E. Gray.

L. difformis, Aresch. (= *L. tuberiformis*, Phyc. Brit.).

COHORT LAMINARINÆ.

Order Scytosiphonaceæ.

Phyllitis, Kütz.

P. fascia, Kütz. (= *Laminaria fascia*, Phyc. Brit.).

Scytosiphon, C. Ag.

S. lomentarius, J. Ag. (= *Chorda lomentaria*, Phyc. Brit.).

Order Chordaceæ.

Chorda, Stackh.

C. filum, Stackh.

Order Laminariaceæ.

Laminaria, Lamx.

L. saccharina, Lamx.

L. saccharina, Lamx., f. *Phyllitis*, Le Jol. (= *L. Phyllitis*, Phyc. Brit.).

L. digitata, Edm.

Saccorhiza, De la Pyl.

S. bulbosa, De la Pyl. (= *Laminaria bulbosa*, Phyc. Brit.).

Alaria, Grev.

A. esculenta, Grev.

COHORT CUTLERINÆ.

Order Cutleriaceæ.

Aglaozonia, Zan.

A. reptans, Kütz. (= *Zonaria parvula*, Phyc. Brit.).

Cutleria, Grev.

C. multifida, Grev.

COHORT FUCINÆ.

Order Fucaceæ.

Fucus, Dcne. et Thur.

F. ceranoides, Linn.

F. vesiculosus, Linn.

F. serratus, Linn.

Ascophyllum, Stackh.
A. nodosum, Le Jol. (= *Fucus nodosus*, Phyc. Brit.).
Pelvetia, Dcne. et Thur.
P. canaliculata, Dcne. et Thur. (= *Fucus canaliculatus*, Phyc. Brit.).
Halidrys, Lyngb.
H. siliquosa, Lyngb.

COHORT DICTYOTINÆ.

Order Dictyotaceæ.

Dictyota, Lamx.
D. dichotoma, Lamx.

SERIES RHODOPHYCEÆ.

COHORT PORPHYRINÆ.

Order Porphyraceæ.

Erythrotrichia, Aresch.
E. carnea, J. Ag.
Porphyra, C. Ag.
P. laciniata, C. Ag.

COHORT NEMALIONINÆ.

Order Helminthocladiaceæ.

Acrochætium, Näg. (= *Callithamnion virgatula*, Phyc. Brit.).
A. virgatula, J. Ag. (= *Call. Daviesii*, Phyc. Brit.).
A. Daviesii, Näg.

Order Chætangiaceæ.

Tribe Scinaieæ.

Scinaia, Bivona.
S. furcellata, Bivona (= *Ginnania furcellata*, Phyc. Brit.).

Order Gelidiaceæ.

Tribe Gelidieæ.

Gelidium, Lamx.
G. crinale, J. Ag.

COHORT GIGARTININÆ.

Order Gigartinaceæ.

Tribe Gigartineæ.

Chondrus, J. Ag.
C. crispus, Stackh.

Gigartina, Stackh.
G. mamillosa, J. Ag.
G. acicularis, Lamx.

Tribe Tylocarpeæ.

Phyllophora, Grev.
P. rubens, Grev.

Tribe Rhodophyllideæ.

Rhodophyllis, Kütz.
R. appendiculata, J. Ag.

COHORT RHODYMENINÆ.

Order Rhodymeniaceæ.

Tribe Rhodymenieæ.

Rhodymenia, J. Ag.
R. palmata, Grev.
R. palmata, Grev., f. *sobolifera*, J. Ag.
Lomentaria, Lyngb.
L. articulata, Lyngb. (= *Chylocladia articulata*, Phyc. Brit.).
L. clavellosa, Gaill. (= *Chrysymenia clavellosa*, Phyc. Brit.).
Chylocladia, Grev.
C. kaliformis, Grev.

Tribe Plocamieæ.

Plocamium, Lyngb.
P. coccineum, Lyngb.

Order Delesseriaceæ.

Tribe Nitophylleæ.

Nitophyllum, Grev.
N. laceratum, Grev.
N. Bonnemaisonii, Grev.
N. versicolor, Harv.

Tribe Delesserieæ.

Delesseria, Lamx.

D. alata, Lamx.

D. sinuosa, Lamx.

D. sanguinea, Lamx.

Order Bonnemaisoniaceæ.

Bonnemaisonia, C. Ag.

B. asparagoides, C. Ag.

Order Rhodomelaceæ.

Tribe Rhodomeleæ.

Rhodomela, C. Ag.

R. subfusca, C. Ag.

R. lycopodioides, C. Ag.

Odonthalia, Lyngb.

O. dentata, Lyngb.

Tribe Polysiphonieæ.

Polysiphonia, Grev.

P. urceolata, Grev.

P. urceolata, Grev., f. *patens*, J. Ag.

P. violacea, Wyatt.

P. fastigiata, Grev.

P. simulans, Harv.

P. nigrescens, Grev.

P. fibrata, Harv.

P. Brodiæi, Grev.

P. elongata, Grev.

P. fibrillosa, Grev.

P. formosa (J. Ag. ?).

Pterosiphonia, Falk. (= *Polysiphonia parasitica*, Phyc. Brit.).

P. parasitica, Schm.

Brogniartella, Illont. (= *Polysiphonia byssoides*, Phyc. Brit.).

B. byssoides, Schm.

Order Ceramiaceæ.

Tribe Spermothamnieæ.

Spondylothamnion, Näg.

S multifidum, Näg. (= *Wrangelia multifida*, Phyc. Brit.).

Spermothamnion, Aresch.

S. Turneri, Aresch. (= *Callithamnion Turneri*, Phyc. Brit.).

Tribe Griffithsieæ.

Griffithsia, C. Ag.

G. corallina, C. Ag.

G. setacea, C. Ag.

Tribe Callithamnieæ.

Rhodochorton, Näg.

R. floridulum, Näg.

Callithamnion, Lyngb.

C. polyspermum, C. Ag.

C. Hookeri, C. Ag.

C. arbuscula, Lyngb.

C. tetragonum, C. Ag.

C. corymbosum, Lyngb.

C. granulatum, C. Ag.

C. byssoides, J. Ag.

Tribe Ptiloteæ.

Plumaria, Schmitz.

P. elegans, Bonnem.

Ptilota, C. Ag.

P. plumosa, C. Ag.

Tribe Crouanieæ.

Antithamnion, Näg.

A. plumula, Thur. (= *Callithamnion plumula*, Phyc. Brit.).

Tribe Ceramieæ.

Ceramium, Lyngb.

C. tenuissimum, J. Ag. (= *C. nodosum*, Phyc. Brit.).

C. diaphanum, Roth.

C. rubrum, C. Ag.

C. acanthonotum, Carm.

Order Dumontiaceæ.

Dudresnaya, Bonnem.

D. coccinea, Bonnem.

Dilsea, Stackh.

D. edulis, Stackh.

Tribe Halarachnieæ.

Halarachnion, Kütz.

H. ligulatum, Kütz. (= *Halymenia ligulata*, Phyc. Brit.).

Furcellaria, Lamx.

F. fastigiata, Lamx.

Order Rhizophyllidaceæ.

Polyides, C. Ag.

P. rotundus, Grev.

Order Corallinaceæ.

Lithothamnion, Phil.

L. fasciculatum, Aresch. (= *Melobesia fasciculata*, Phyc. Brit.).

L. coralloides, Crn., f. *subsimplex*, Batt.

L. polymorphum, Aresch. (= *Melobesia polymorpha*, Phyc. Brit.).

Corallina, Lamx.

C. officinalis, Linn.

C. rubens, Ellis et So.. (= *Jania rubens*, Phyc. Brit.).

ADDENDA.

Order Sphacelariaceæ.

Sphacelaria, Lyngb.

S. radicans, Harv.

Order Chordariaceæ.

Spermatochnus, Kütz.

S. Lejolisii, Rke.

Tribe Gracilarieæ.

Gracilaria, Grev.

G. confervoides, Grev.

Tribe Dasyeæ.

Dasya, C. Ag.

D. coccinea, C. Ag.

D. coccinea, C. Ag., f. *tenuis*, J. Ag.

Tribe Monosporeæ

Monospora, Solier.

M. pedicellata, Solier.

Botanical Notes from Galloway for 1896.

By James M'Andrew, Assoc. Bot. Soc. Edin., New Galloway.

[Read 25th May, 1897.]

Wigtownshire.—In continuation of former short papers on the botany of the three south-western counties of Scotland, and especially with respect to new records of plants, I shall very briefly sum up the results of my work during July and August of 1896. The new records for Wigtownshire are—1. *Milium effusum*, Linn., in Wood of Park, Glenluce; 2. *Potamogeton lucens*, Linn., in Whitefield Loch, Glenluce; 3. *Mentha sativa*, Linn., var. *paludosa* (Sole), Sorbie Burn; 4. *Lathyrus macrorrhizus*, Wimm., var. *tenuifolius*, Roth, near Moss Park, Sorbie, by the Rev. James Gorrie; 5. *Ballota nigra*, Linn., Rigg Bay, Garliestown. In two stations at the head of Luce Bay I gathered *Thalictrum minus*, Linn., var. *maritimum*, Syme; *Ruppia rostellata*, Koch, was in great abundance in lagoons round the isle of St. Helena, Glenluce; at Glenluce Abbey were *Lithospermum officinale*, Linn., *Barbarea præcox.*, R.Br., *Verbascum Thapsus*, Linn.; and near the Abbey *Prunus insititia*, Huds. Here I failed to find *Arum maculatum*, Linn., and *Parietaria officinalis*, Linn. Along the shore south of Glenluce grow *Galium Mollugo*, Linn., *Scabiosa arvensis*, Linn., *Carduus tenuiflorus*, Curt.; but I failed to find the following plants recorded for the neighbourhood of Glenluce by the Rev. George Wilson:—*Lobelia Dortmanna*, Linn., *Galium cruciatum*, Scop., *Teesdalia nudicaulis*, R. Br., and *Stachys Betonica*, Benth. *Potamogeton perfoliatus*, Linn., grows in Whitefield Loch. In Rigg Bay, Garliestown, now grow in abundance *Hyoscyamus niger*, Linn., and *Datura Stramonium*, Linn. Here also are *Beta maritima*, Linn., *Atriplex littoralis*, Linn., *Atriplex deltoidea*, Bab., form *marina*, *Atriplex Babingtonii*, Woods, var. *virescens*, Lange, and *Rumex conglomeratus*, Murr.

Kirkcudbrightshire.—The following are new records for this county:—1. *Poa trivialis*, Linn., var. *Koeleri* (DC.); 2. *Avena*

pubescens, Huds.; 3. *Potamogeton pectinatus*, Linn., west of Southerness. I was fortunate in being able to confirm *Scirpus Tabernæmontani*, Gmel., for Kirkcudbrightshire. It grows in abundance west of Southerness and also north of the mouth of Kirkbean Burn. Near Kirkbean I also confirmed *Leontodon hispidus*, Linn., for this county. At Southerness I failed to find *Lepturus filiformis*, Trin., var. *incurvatus* (Trin.), *Brassica monensis*, Huds., and *Convolvulus Soldanella*, Linn. These plants were formerly gathered in this locality. *Brassica monensis*, Huds., seems to be extinct from both Wigtownshire and Kirkcudbrightshire. *Apium graveolens*, Linn., *Juncus obtusiflorus*, Ehrh., *Scrophularia aquatica*, Linn., and *Ruppia rostellata*, Koch, still hold their ground near the Needle's Eye, Colvend. Criffel I found very unproductive. Along the Arbigland shore are *Ononis spinosa*, Linn., *Sanguisorba officinalis*, Linn., *Calamintha Clinopodium*, Spenn., *Potentilla reptans*, Linn., &c.; in Arbigland Woods I got *Epipactis latifolia*, All.; near Kirkbean, *Allium carinatum*, Linn., *Claytonia alsinoides*, Sims, *Blysmus compressus*, Panz., *Senecio viscosus*, Linn., *Tragopogon pratensis*, Linn.; in Kirkbean Glen were *Milium effusum*, Linn., *Bromus asper*, Murr., *Festuca gigantea*, Vill., *Melica uniflora*, Retz., *Carex sylvatica*, Huds., and *Polystichum lobatum*, Presl. It is strange that none of the following littoral plants has been recorded from Dumfriesshire, though several of them occur in Kirkcudbrightshire, on the opposite side of the River Nith. The reason, probably, is the unsuitability of the shore. The plants I mean are: *Senebiera Coronopus*, Poiret, *Scirpus Tabernæmontani*, Gmel., *Ligusticum scoticum*, Linn., *Crithmum maritimum*, Linn., *Inula crithmoides*, Linn., *Pulicaria dysenterica*, Gærtn., *Mertensia maritima*, Don, *Beta maritima*, Linn., *Atriplex laciniata*, Linn., *Zostera marina*, Linn., *Ruppia rostellata*, Koch, *Suæda maritima*, Dum., *Cramle maritima*, Linn., *Carex arenaria*, Linn., *Geranium sanguineum*, Linn. Again, the following plants, though occurring in the counties of Kirkcudbright or Wigtown, have not yet been recorded for Dumfries:—*Hypericum elodes*, Linn., *Pinguicula lusitanica*, Linn., *Scutellaria minor*, Huds., *Vicia lathyroides*, Linn., *Scirpus fluitans*, Linn., &c. Attention requires to be directed to the existence or non-existence in the district of such plants as the following, which were recorded about fifty or sixty years ago:—

Lychnis Viscaria, Linn., *Bromus erectus*, Huds., *Phleum arenarium*, Linn., *Melampyrum sylvaticum*, Linn., *Bartsia viscosa*, Linn., *Eriophorum latifolium*, Hoppe, *Lithospermum arvense*, Linn., *Elymus arenarius*, Linn., &c. During last summer the following have been gathered in the neighbourhood of Dumfries :— *Alyssum incanum*, Linn., *Lepidium Draba*, Linn., *Saponaria Vaccaria*, Linn., *Peucedanum Ostruthium*, Koch, *Solanum nigrum*, Linn., *Origanum vulgare*, Linn., *Mimulus luteus*, Linn., *Acorus Calamus*, Linn., *Linum perenne*, Linn., &c.

Among cryptogams I gathered *Hypnum lutescens*, Dill. (a new record for Kirkcudbrightshire), at Southerness ; *Hypnum depressum*, Bruch, in Kirkbean Glen ; *Rhabdoweissia crenulata*, Jameson, on Criffel ; *Hypnum fluviatile*, Swartz, in Prestonmill Burn, &c. From information received from Mr. James Murray, Hamilton, I am able to add a few more mosses to the local list— *Andreæa falcata*, Schr., *Racomitrium protensum*, Braun, *Hypnum aduncum*, Hedw., *Orthothecium intricatum*, B. & S., and *Hypnum molluscum*, Dill., var. *condensatum*, Schp., *Hypnum eugyrium*, Schr., all in the Glenkens ; *Bryum pendulum*, Schp., at Cluden Mills, Dumfries ; *Rhynchostegium murale*, Hedw., Irongray ; and *Fissidens exilis*, Hedw., about Drumlanrig.

Notes on the Mycology of Kelvingrove Park.

By William Stewart.

[Read 27th October, 1896.]

A young mycologist would probably despise the Glasgow public parks as a field for investigation, under the impression that so well-kept grounds do not afford the necessary conditions for the development of organisms which flourish best where decay and disorder reign. And it is true that the old woods of a neglected estate afford the student the best hunting-grounds for Fungi, which, with the beetles, are Nature's scavengers, specially designed to hasten the decay, and assist in the speedy removal of higher organisms that have served their day and generation, and become cumberers of the ground. In such a situation the profusion of Fungi is only puzzling to a young student, and a field that only offers a few varieties will prove more profitable, as his attention is then fixed on only a few species, and he gets their general appearance and peculiar characteristics so impressed on his memory that he readily recognises them at a second finding. From this consideration the parks offer a favourable and convenient field for beginners, and will be found worthy of attention by those even well advanced, for I have seldom visited any of them in suitable conditions of season and temperature without being rewarded by the finding of some to add to the record. When we remember that Glasgow now possesses thirteen parks, with convenient means of reaching them, several of them of large acreage and fairly wooded, it must be apparent that it will repay a mycologist who cannot spare time for a distant foray to take an occasional excursion through grounds so easily accessible. On a visit to Cathkin Park Professor Thomas King and I made a very good list on a day this year which was not very favourable. As Professor King took the notes, I cannot give the numbers, but we were surprised at its length under unfavourable conditions.

Kelvingrove Park is the only one to which anything like regular attention has been devoted, and of which a record has been kept. Should any one be disposed to take any of the other parks under his care, I shall gladly give what help I can in identifying species, and warmly welcome another worker in this interesting, but neglected field.

The record for Kelvingrove extends to upwards of fifty species, comprised in nineteen genera and fifteen subgenera—a number of the species being not at all common, four of them rare, and one yet unidentified, and which may prove to be new.

A large proportion of these belong to the Hymenomycetes, and of these twenty-five are Agarics, representatives of about one-half the subgenera in the British lists.

Of the Polypori there are six—*Polyporus frondosus*, Fr., however, being a disputed identification, one high authority maintaining that it is a form of *P. giganteus*, Fr.

The only British Fistulina—*Fistulina hepatica*, Fr.—has been found, and, of course, the ubiquitous *Merulius lachrymans*, Fr., had to be turned out of the Museum; while two Stereums and one Clavaria are in the record, along with *Dacrymyces stillatus*, Nees, which closes our list of Hymenomycetes.

Of the Gasteromycetes, the second great family, we have only three, each representative of a different order and genus—*Phallus impudicus*, Linn., *Lycoperdon gemmatum*, Fr., and *Crucibulum vulgare*, Tul.

Of the third and fourth families we have no record—the Coniomycetes and the Hyphomycetes; but of the fifth, the Ascomycetes, we have two species of Peziza, one Encœlia, one Xylaria, and one Nectria.

I append a complete list of species found in the park, identified by Professor King or myself, all those doubtful or unknown having been verified by Dr. Stevenson, Dr. Keith, or Dr. Cooke, but the following notes on a few which are uncommon or rare may be interesting:—

Fistulina hepatica, Fr., appears in Mr. J. M. Campbell's notes as having been found on an oak cut down on what is known as the Oak Walk. It was identified by some of the mycologists attending the British Association meeting in Glasgow in 1876. The same authorities found, and pointed out to Mr. Campbell,

Cantharellus cibarius, Fr., growing on the Kelvin bank behind the Museum. Professor King and I found it about 1890, I think, on a tree on the banks of the Kelvin, opposite the Botanic Gardens, near the new bridge.

Merulius lachrymans, Fr., or Dry-rot, attacked the flooring of the Museum in 1887, but with some trouble and expense it was extirpated apparently, for it has not reappeared.

Agaricus (*Lepiota*) *acutesquamosus*, Weinm., is a rare species found this year among the shrubbery on the north bank of the Kelvin, near the iron bridge. It is a beautiful plant, regularly marked with twisted sharp-pointed scales when young, developing into regular squarrose patches, and showing the white between as it grows older. Mr. Macgregor, of Paisley, sent me a specimen in the latter condition last month, which he had found growing on the floor of his dyework. These are the only specimens I have seen, though Professor King told me he had found it once. Dr. Stevenson calls acutesquamosus "a most distinguished species."

Agaricus (*Tricholoma*) *gambosus*, Fr., St. George's Mushroom, was found this year above the ladies' waiting-room. It is a spring species, and said to be common in England. I had never found it before.

Agaricus (*Tricholoma*) *subpulverulentus*, Pers., an uncommon one, was found in 1884.

Agaricus (*Nolanea*) *pisciodorus*, Ces., with a strong fishy smell, we have found once or twice elsewhere, but it is not a common species.

Agaricus (*Pholiota*) *aureus*, Müll., a beautiful golden-tawny species, was found in 1888 and 1889 in the shrubbery near the entrance to the nursery grounds. The only record for it in Dr. Stevenson's *British Fungi* is Dumfries Show of the Cryptogamic Society. As the alteration of the ground in connection with the building of the Prince of Wales's Bridge has covered up the site, I am afraid we have little hope of again seeing this beautiful and rare species.

Agaricus (*Pholiota*) *togularis*, Bull., is given as rare by Dr. Stevenson. It is remarkable for the ring, which is entire and hangs down like a cloak, from which it gets its name (*togula*, a little cloak).

Agaricus (*Pholiota*) *spectabilis*, Fr., is not rare, but it is not common, and is a very handsome species when it appears in good condition.

Agaricus campestris, Linn., the Common Field Mushroom, and its two allies, *A. arvensis*, Schæff., and *silvicola*, Vitt., find a place on our list—the first having been found frequently on the soil prepared for potting in the nursery grounds; and the others, one near the fountain and one near the gate at the Queen's Rooms.

Hygrophorus Clarkii, B. & Br., the only Hygrophorus on our list, is a rare one, Dr. Stevenson's record being Perth Fungus Show.

Boletus pachypus, Fr. The only representative of the Boleti is pachypus, an uncommon species, and rather a handsome one.

Phallus impudicus, Linn., has appeared pretty frequently near the gate at the Queen's Rooms, its presence, when it has appeared, being known from a considerable distance.

Crucibulum vulgare, Tul., was found on the site of the 1888 Exhibition along with *Peziza scutellata*, Linn., but Mr. Campbell assures me that it is of frequent appearance about the neighbourhood of the Museum.

The foregoing are the most interesting of the species hitherto recorded for Kelvingrove Park, but it is probable that careful attention will furnish many additions to our list.

List of Fungi in Kelvingrove Park.

Agaricus (*Lepiota*) *acutesquamosus*, Weinm. Shrubbery near iron bridge, rare, 1896.

A. (*Lepiota*) *cristatus*, A. & S.

A. (*Armillaria*) *melleus*, Fl. Dan. Very common.

A. (*Tricholoma*) *gambosus*, Fr. Near ladies' waiting-room.

A. („) *subpulverulentus*, Pers. Not common.

A. (*Clitocybe*) *nebularis*, Batsch.

A. (*Collybia*) *radicatus*, Rehl.

A. („) *velutipes*, Curt.

A. (*Mycena*) *galericulatus*, Scop.

A. („) *pascuus*, Pers.

A. (*Nolanea*) *pisciodorus*, Ces. Not common.

A. (*Pholiota*) *aureus*, Müll. Rare, 1888 and 1889.

A. („) *togularis*, Bull. Rare, 1896.

A. („) *spectabilis*, Fr. Not common.

A. (*Hebeloma*) *crustuliniformis*, Bull.

A. (*Galera*) *tener*, Schæff.

A. (*Psalliota*) *arvensis*, Schæff.
A. („) *campestris*, Linn.
A. („) *silvicola*, Vitt.
A. (*Stropharia*) *æruginosus*, Curt.
A. (*Hypholoma*) *fascicularis*, Huds.
A. („) *velutinus*, Pers.
A. (*Psilocybe*) *semilanceatus*, Fr.
A. („) *cernuus*, Fl. Dan.
A. (*Psathyrella*) *disseminatus*, Pers.
Coprinus comatus, Fr.
C. atramentarius, Fr.
C. micaceus, Fr.
Paxillus involutus, Fr.
Hygrophorus Clarkii, B. & Br. Rare, 1887.
Cantharellus cibarius, Fr. 1876.
Boletus pachypus, Fr. Not common, 1884.
Polyporus frondosus, Fr.?
P. giganteus, Fr.
P. adustus, Fr.
P. vulgaris, Fr.
P. versicolor, Fr.
P. squamosus, Fr.
Merulius lachrymans, Fr. Museum, 1879.
Fistulina hepatica, Fr.
Stereum purpureum, Pers.
S. hirsutum, Fr.
Clavaria fastigiata, Linn.
Dacrymyces stillatus, Nees. Very common.
Phallus impudicus, Linn.
Lycoperdon gemmatum, Fr.
Crucibulum vulgare, Tul. Site of 1888 Exhibition, frequent.
Peziza domestica, Sow.
P. scutellata, Linn.
Encœlia fascicularis, Fr.
Xylaria hypoxylon, Grev.
Nectria cinnabarina, Fr.

Preliminary Note on the Shapes of Leaves.

By G. F. Scott Elliot, M.A., B.Sc., F.L.S., F.R.G.S.

[Read 29th December, 1896.]

Names of the different shapes of leaves occupy so much space in all text-books of botany that it is somewhat remarkable to find that very little is known as to the reasons of these shapes, of the cause of these variations, or of any geometrical idea underlying their complexities.

In a general way, the aim of a leaf in a temperate climate is to obtain as much sunlight as possible. An excellent paper by Sir John Lubbock (*Flowers, Fruits, and Leaves*, London, 1888) clearly brought out this principle, namely, that the leaves on a tree supplement and do not interfere with one another. The whole set fit into one another's vacancies in such a manner as to form a nearly perfect light-catching surface or screen.

This principle, in a temperate country, cannot possibly be controverted, and must underlie all future work on the subject.

We may divide leaves roughly as follows :—

1. Circular or orbicular leaves.
2. Elliptic, rotundate, oval, or leaves which are broadest in the middle.
3. Obovate, oblanceolate, &c., *i.e.*, broadest towards the apex.
4. Ovate, lanceolate, &c., *i.e.*, broadest towards the base.
5. Palmate, such as the Ivy leaf.

All these types are, of course, connected by various transitional forms. The type 3, or obovate leaf, is in some respects the simplest. I shall first take the rosette type of plant, which has all its leaves radical and has no internodes. This is a very common form, and is apparently a very ancient or primeval design. It is obvious that the bases must be wedge-shaped and fit into one another, whilst the outer edge may not improbably be circular in outline. The most usual number of leaves in the complete leaf-spiral, before a leaf is reached which is directly above the starting-

point, varies from 3 to 21. The phyllotactic spirals are, in fact, usually $\frac{1}{3}$, $\frac{2}{5}$, $\frac{3}{8}$, $\frac{5}{13}$, $\frac{8}{21}$, or the successive convergents of the continued fraction $\cfrac{1}{2+\cfrac{1}{1}}$, &c.

1. With a $\frac{1}{3}$rd fraction, or with three leaves in the circle, we should expect a leaf to have a wedge-shape at the base with an angle of 120 degrees. I have found no rosette with this arrangement. The leaflets of Trifolium and Oxalis, however, approximate to this idea.

2. With a fraction of $\frac{2}{5}$th phyllotaxis we should have five leaves in the circle, and each should have an angle at the centre of 72°. Now to apply this to actual leaves there are two methods. By averages, or by taking any actual leaf chosen under no special rule. The latter method has been adopted. The leaf of *Peplis Portula*, Linn., is a very close approximation to this idea, but in the leaf measured the angle was 75°.

With the $\frac{3}{8}$th phyllotaxis, or eight leaves in the whorl, the angle at the centre should be an eighth of 360°, or 45°. I found by measurement—

In *Bellis perennis*, Linn.,	42°
Hieracium aurantiacum, Linn.,	42°
Vaccinium uliginosum, Linn.,	44°
Antennaria dioica, R. Br.,	47°

The geometrical idea seems to be followed very closely in these forms.

Taking $\frac{5}{13}$th, then for 13 leaf bases to fully occupy the circle each should have an angle of 27° to 28°. I found that the angle was—

In *Arctostaphylos Uva-ursi*, Spreng.,	23°
Taraxacum officinale, Web.,	26°
Hypochœris radicata, Linn.,	26°
Arabis hirsuta, Scop.,	27°

This general result of very fairly close correspondence of course struck me as remarkable. In the short time available to me I had simply measured only two other obovate leaves. These were—

Vaccinium Vitis Idœa, Linn.,	52°
Corrigiola littoralis, Linn.,	13°

Therefore, to find that nine out of eleven, chosen without any idea of this relationship, fit into the usual phyllotactic spirals, seems to me encouraging. Of course, some of them, *e.g.*, Vaccinium and Arctostaphylos, are not plants with their leaves in rosettes.

The above idea is not original, for the suggestion occurs in the work mentioned above. Sir John Lubbock goes on to point out a principle which is of great importance. If the angle or plane of the leaf to incident light is not exactly transverse or at right angles, but more or less inclined, it is obvious that, to understand its shape, the projection or shade in the plane at right angles to incident light must be studied. In the paper referred to, *Drosera intermedia*, Hayne, is shown to be comparable to the Common Drosera, and *Plantago lanceolata*, Linn., to *P. media*, Linn. (p. 134). Thus the leaf of Hypochœris is very nearly the theoretical leaf of the $\frac{5}{13}$ phyllotaxis. The ordinary treatment in the best text-books is misleading on this point. Green, *Manual of Botany*, vol. ii., p. 493, says—"They place themselves so as to present their upper surfaces at right angles to the incident rays." Vine's *Student's Text-book*, p. 748—"Dorsiventral members (morphologically upper . . . surface) . . . lie in a plane perpendicular to the direction of incidence of the rays." This is probably founded on Frank's researches, *Bot. Zeitung*, 1873, p. 17; but both De Vries and Darwin have shown that this rule, or rather tendency, is modified both by the weight of the leaf and the tendency to grow upwards. (Cf. *Movements of Plants.*) In fact, the usual history of a leaf in this country is as follows:—In the bud condition it is either vertical or curved inwards. As it matures, it first straightens itself, and then gradually curves outwards, bending over until it may either be in a direction at right angles to incident light, or even hang below that position. It may be fixed at any point in this series of changes. The very slightest observation in the field shows that the transverse position is neither universal nor even usual. This course of development explains the necessity of taking into account the "shade projection" of leaves, or their inclination to incident light.

Taking next the palmate type of leaf, such as the Ivy, it is at first sight impossible to get a definite geometrical idea underlying its shape. After I had several times given up the attempt, I

thought of the hexagon as a shape which gives a theoretically perfect packing. Taking sections of a hexagonal prism, I found the following possible explanation. Many Ivy leaves are very nearly the shape of a hexagon, with a small triangle cut out of one side and attached to the opposite side. There are, however, but few leaves which are perfect hexagons. A very large number, on the other hand, are extremely close approximations to the sections of a hexagonal prism.

Not merely palmate, but also many ovate-cordate leaves, fall under one or the other of the following sections of a hexagonal prism, which may be classified as follows :—

1. True regular hexagons (example, many Ivy leaves).

2. Sections of a hexagonal prism which have four of their sides equal to one another.

   a. Sections which pass through one of the sides of the original hexagon. This may be called the "shadow hexagon." The section passes from a side to a side of a parallel regular hexagon prism.

   b. Sections which have none of their sides parallel to the original hexagon. This may be called the "diamond section." It is, of course, due to the section passing from a rib of the hexagon to a rib.

3. Sections of a hexagon which have not four equal sides. These are not inclined to the prism in such a manner as to contain either a diagonal or a line joining two opposite sides.

   a. These are most simply described as the "skew shadow hexagon."

   b. The "skew diamond."

As a good example of the true shadow hexagon, there is *Polygonum Convolvulus*, Linn., which is very nearly the exact shape; also *Lamium sp.*, *Viola canina*, Linn., *Urtica dioica*, Linn., and even such an unlikely case as *Cochlearia officinalis*, Linn. Amongst other forms of leaf which appear to me to have this leading idea, I may mention, *Humulus Lupulus*, Linn., *Acer campestre*, Linn., *Lavatera arborea*, Linn., *Wahlenbergia hederacea*, Reichb., *Viola pumila*, Hook. & Arn., *Nepeta Glechoma*, Benth., &c. Those which are ovate-cordate tend to pass into the nearly circular leaves of such forms as *Viola odorata*, Linn., and *Calystegia Soldanella*, Linn.

The fact that such leaves as, *e.g.*, Villarsia have a nearly circular shape, is to my mind simply explained by the consideration that, as they are nearly symmetrically arranged with regard to all external agencies such as light and air, &c., there is no reason why they should elongate further in one direction than in another, and therefore must be circular. These leaves are not exposed to interference from their neighbours, which would prevent this equal development. As further examples of this circular type, Nuphar, Nymphæa, *Hydrocotyle vulgaris*, Linn., *Ranunculus peltatus*, Schrank, and *Viola palustris*, Linn., may be mentioned.

Turning now to the diamond type of leaf, there are many oval, elliptic, and even linear leaves which can be placed here. The leaves of *Veronica hederæfolia*, Linn., *Polygonum Roberti*, Loisel, *Dentaria bulbifera*, Linn., *Parietaria officinalis*, Linn., *Epilobium roseum*, Schreb., can be fitted together in a nearly perfect manner. Amongst others may be mentioned *Arenaria trinervia*, Linn., *Epilobium alpinum*, Linn., *Galeobdolon luteum*, Huds., *Polygala vulgaris*, Linn., Polycarpon, and *Hieracium murorum*, Linn.

Some of these leaves give, to my mind, patterns of great beauty, probably in consequence of the perfect manner in which they fit one another.

So far the ovate type of leaf, except when it is broadly ovate, and cordate at base, has not been alluded to. I shall just mention a curious point with regard to the leaves of *Saponaria officinalis*, Linn, and *Mentha sativa*, Linn. These plants have their leaves opposite and in four rows. The angle of the wedge-shaped base is in both a right angle, whilst the angle at the apex is 60°. The bases of the four leaves thus fit exactly, but the exact geometrical idea of this shape is not very clear.

The point which I wished to discover was whether the question could be simplified by the finding of a geometrical idea or plan, which a leaf will, of course, vary to suit its own individual needs. These variations in individuals are sometimes distinctly connected with variations in the environment (as I tried to show in a paper read before the Linnean Society, December 18th, 1890; see *Journal of the Linnean Society*, vol. xxviii.); but without some clear plan or geometrical idea, it is obvious that the fitting could not be as perfect as it now is.

The Constancy of the Bee.

By George W. Ord.

[Read 29th December, 1896.]

In order to explain the development of plant species, extreme Darwinians have always laid great stress on the "Constancy of the Bee," and the bee-selection theory is, and has always been, one of the great pillars of the Law of Natural Selection.

My attention was first drawn to this subject by a paper in *Science Gossip*, May, 1892, in which the author, Mr. G. W. Bulman, tried to show that "the curious habit of the Apidæ of visiting only one species of flower in a single excursion," existed only in the minds of those who wrote about it. He gave detailed accounts of a great number of observations which formed a remarkable series. One of the bees which he watched changed 10 times in 27 visits, between the following plants:—*Geranium Robertianum*, Linn., *G. lucidum*, Linn., *G. nemorum*?, and *G. sanguineum*, Linn.

Mr. Bulman's paper struck me very forcibly at the time, and I began to make observations, and have continued to do so at intervals during the last five seasons. During this time I have watched some hundreds of bees, and what I have observed seems only to confirm the experience of Mr. Bulman. Of the total number observed by me, only about 30 per cent. have proved inconstant while they were under my eye, but the fact must be taken into consideration that I lost sight of the majority after they had paid one or two visits to flowers. In most cases, when I was able to follow the bee for any considerable time, I found that, sooner or later, a change was made. This, however, was not always the case, and I have recorded several very interesting instances of constancy. One bee, which I watched for a long time on the 14th of June this year, confined itself entirely to the flowers of the Bugle, although there were numerous other flowers in the neighbourhood, including Stitchwort, Hyacinth, &c. Furthermore, bees which are working Willow or Lime trees never seem to bother with other flowers, though, so far as I have been able to

make out, little or no difference is made between the various species of Salix. On Heather (*Calluna Erica*, DC.), bees are also fairly constant, though, with the Humble-bees at any rate, changes to the two common species of heath (*Erica Tetralix*, Linn., and *E. cinerea*, Linn.) are very frequent, and between these two I have seen *Bombus muscorum*, Linn., change as often as five times in eight visits. I will now give one or two striking instances of the "inconstancy" of the bee. There is a bank on the road from Busby Station to Carmunnock, where the two species of Avens, *Geum rivale*, Linn., and *G. urbanum*, Linn., and also the hybrid *G. intermedium*, Ehrh., are all growing together. On this bank I have watched bees often working at these flowers, and have never seen a single instance of strict constancy. Visits to *Geum urbanum*, Linn., were by no means so frequent as to the other two, and some bees confined themselves to *Geum rivale*, Linn., and the hybrid. The following record of the behaviour of a Humble-bee (*Bombus sylvarum*, Linn., I believe) is perhaps the most striking :—

Geum rivale, Linn.,	... ...	2 visits.
intermedium, Ehrh.,	...	1 visit.
rivale, Linn.,	... ...	1 ,,
intermedium, Ehrh.,	...	2 visits.
urbanum, Linn.,	...	2 ,,
rivale, Linn.,	... ...	6 ,,
intermedium, Ehrh.,	...	3 ,,
urbanum, Linn.,	...	1 visit.

or 7 changes in 18 visits.

At Chryston, in June, 1892, I watched a number of bees working at Marsh Marigold and the Lesser Celandine. Almost every one of them shifted at intervals from one plant to the other. A Hive-bee gave—

Caltha pulustris, Linn.,	...	7 visits.
Ranunculus Ficaria, Linn.,	...	2 ,,
Caltha pulustris, Linn.,	...	3 ,,
Ranunculus Ficaria, Linn.,	...	2 ,,
Caltha pulustris, Linn.,	...	3 ,,

4 changes in 17 visits.

Among many other changes which I have noted, where wild flowers were concerned, I may mention Broom to Hyacinth, Hyacinth to Dog's Mercury, Hyacinth to Stitchwort, Stitchwort to *Orchis mascula*, Linn., Dandelion to *Orchis maculata*, Linn., *Trifolium repens*, Linn., to *Trifolium pratense*, Linn. (3 changes in 5 visits), *Centaurea nigra*, Linn., to *Scabiosa Succisa*, Linn. (2 changes in 7 visits), *Campanula rotundifolia*, Linn., to *Thymus Serpyllum*, Fr., and thence to *Teucrium Scorodonia*, Linn., *Anthyllis Vulneraria*, Linn., to *Lotus corniculatus*, Linn., *Senecio Jacobæa*, Linn., to *Carduus arvensis*, Hoffm., and from that to *Carduus lanceolatus*, Willd.

My most remarkable results were got in gardens, and I will give two cases in detail. The first records the visits of a Hive-bee in the Kibble Palace—

Cytisus racemosus, Hort., ...	2 visits.
Primula obconica, Hance, ...	1 visit.
Tremandra ericetata, ...	1 ,,
Eupatorium (sp. ?—pink coloured), ...	2 visits.
,, (sp. ?—white coloured), ...	2 ,,
	4 changes in 8 visits.

I did not think it necessary to follow this bee any further. It took everything that came in its way, Leguminosæ, Primulaceæ, Compositæ—yellow flowers, pink flowers, white flowers, purple flowers—nothing came amiss. The second case is that of a Humble-bee in a garden at Fintry, Stirlingshire, August, 1893.—

Tropæolum (red flowered), ...	1 visit.
,, (yellow flowered),	2 visits.
,, (red flowered), ...	1 visit.
Viola, ...	1 ,,
Tropæolum (red flowered), ...	2 visits.
Calceolaria (yellow flowered),	1 visit.
,, (red flowered), ...	2 visits.
	6 changes in 10 visits.

I may say that the seed from this bed of Tropæolum was gathered, and a quantity planted behind Kelvingrove Museum. The plants so grown gave a good many pure yellow flowers but hardly a single red one; and many of them were almost equally blotched red and yellow.

In gardens, the bees which remained constant to one species or variety were a very small minority indeed. I have seen such changes as :—Apple-blossom to Dandelion, Apple-blossom to Pear-blossom, Gooseberry to Red Currant and Black Currant, Snapdragon to Pentstemon, Valerian to *Centaurea montana*, Linn.

The results of my observations may be summarised as follows :—

(1) The majority of the bees watched appeared to be constant to one species, yet nearly all those which I was able to follow for any considerable time were by no means so.

(2) Few bees appear to be able to withstand the temptations of a garden.

(3) The Hive-bee appeared to be fully as inconstant as the wild Humble-bees.

(4) The most remarkable examples of constancy were got in the case of the Willow, Lime Tree, Heather, Dog's Mercury, and Bugle.

(5) Changes seemed to be even more frequent where a number of nearly-allied plants grew together. I may say that Dog's Mercury, which is usually considered anemophilous, I have found to be much frequented by the Hive-bee.

Instances of inconstancy in bees might be multiplied many times, but I think I have cited a sufficient number of cases to illustrate all I wanted to say.

It may be said that it is a matter of slight consequence whether the bee visits one species or twenty in the course of a journey, but that is a mistake, for the theory of "bee-selection" depends, to a great extent, on the theoretical constancy of the Apian family. To quote Mr. Bulman's closing sentence "If the bee of to-day passes freely in many cases from one species to another, then surely *a priori* should the bee of bygone ages have passed freely from variety to variety; the results of its visits would be to obliterate the incipient species by crossing it with the parent stock and with other varieties."

A striking example of what such crossing would have brought about was shown in the case of the Tropæolum plants already mentioned, and a better still might have been seen this summer on the road between Busby and Carmunnock, at the place formerly referred to in this paper, plants in all stages of hybridism between *Geum rivale*, Linn., and *Geum urbanum*, Linn., growing alongside the parent species.

Meteorological Notes, and Remarks upon the Weather during the Year 1895, with its General Effects upon Vegetation.

By James Whitton, Superintendent of Parks, Glasgow.

[Read 23rd February, 1897.]

In presenting the accompanying meteorological notes and remarks on the weather of 1895, it may be stated that, while—as mentioned in the Report of last year—there are now meteorological instruments in each of the principal parks, the following observations are based upon the record kept at the Queen's Park. It has been thought convenient to follow this course with a view to preserve the continuity of the series of reports for past years. From the tables appended, however, it will be seen that the results of the observations at the other parks are also shown, and these may be valuable for purposes of comparison and as indicating the difference of climatic conditions in the various districts of the City.

The outstanding feature of 1895, it is perhaps needless to say, was the severe and prolonged frost which characterised the early months of the year, and which has had no parallel for many years.

January.—The year opened with a continuance of the frost which had set in on the 29th December after a long period of very unsettled, stormy weather. By the 4th, the ice on the ponds in the parks was strong enough for skating puposes. On the afternoon of the 5th there was a slight change, with drizzly rain. Intense frost was experienced until the 13th, when another partial thaw occurred, and for four days the atmospheric conditions were extremely disagreeable, as the low temperature was accompanied by a biting N.E. wind and drizzly rain. Thereafter, until the end of the month, there was a continuance of the frost, with occasional showers of snow and many fogs.

On the 10th the trees, &c., in the parks were most beautifully covered with "silver thaw." This striking phenomenon is caused by the deposit of frozen moisture from a sudden warm wave after intense cold, and indicates a coming change in the weather.

Frost was registered on 29 days to the amount of 273°. The lowest readings were 12° on the 9th and 11° on the 29th, giving 20° and 21° of frost respectively. On two occasions, 10th and 11th, the day temperature did not rise above 20°. The average maximum temperature for the month was 34°, and the minimum 23°, against 41° and 31° respectively for January, 1894.

The month's rainfall was light, only 0·58 inch of rain and melted snow being registered.

The barometric readings showed a very irregular pressure throughout the month, with several sharp changes. There was a quick fall for two days before the 15th, when, with a N.E. wind, the weather was unpleasant. The pressure remained at about 28·80 for five days, when there was a sharp rise with westerly winds. Another sharp depression occurred on the 23rd, the reading on the 24th being again 28·80 inches. With a rapid rise, the pressure on the 30th was up to 30·40 inches, when the wind was from the east.

February.—Although no intense frost was recorded during the first week, the weather was bitterly cold, the day temperature being uniformly low, with a keen wind from the N.E. On the 6th and 7th a severe storm of wind and snow swept over the country; the snowfall in the City was about 3 inches in depth. From the 8th until the 13th the frost was intense day and night, and the day temperature did not rise above 30°. On the 10th it did not rise above 20°. The lowest night temperature was also on the 10th, when 34° of frost were registered, or 2° below zero. Frost continued with more or less severity until the end of the month, and was registered every morning. The total amount recorded on the 28 days was 356°.

Although indications of a change appeared on the 23rd, it was not until the 28th that any decided thaw was apparent, when, with a strong S.W. wind, the frost gave way and the ice began to break up. The winds were from the E. and N.E. during the greater part of the month. Only a fractional amount of rain or melted snow was registered, viz., 0·14 inch, in marked contrast to that of February, 1894, when 8·96 inches were registered. The barometric readings do not show any sharp changes, while the range was within one inch—from 29·45 to 30·30—during the month. The only notable drop was from 30 on the 5th to 29·50

on the 6th, when the storm already noted set in, and the lowest reading was on the 7th.

The average day temperature was 34°, and the night 19°, against 44° and 33° in 1894.

March.—After the almost Arctic severity which characterised the weather of the previous month, the open weather which obtained during March was of a pleasant nature, despite the prevalence of dull, sunless days. As an effect of the thaw the harbour at Glasgow on the first of the month was completely blocked by masses of ice from the upper reaches of the river, and a *Clutha* steamer was sunk by the floating blocks. Although the thermometer was only at or below freezing point on nine occasions, and a total of 32° of frost registered, there was an absence of bright sunshine, consequently the average day temperature was somewhat low, being 46°, against 51° in 1894, while the average night temperatures were almost alike, viz., 34° against 33°.

Considering the prevalence of westerly winds, the rainfall was abnormally low, only 1·17 inches falling. There were 15 dry days.

The barometric readings were fairly steady for the first three weeks—between 29·25 and 30 inches. There was a sharp fall from 29·40 on the 23rd to 28·70 inches on the 24th, and, after rising for three days, again sharply dropping to 28·50 inches on the 28th, followed by a quick rise to 29·30 at the end of the month.

The frost having penetrated the ground to a considerable depth, it was not till the middle of the month that vegetation showed signs of being released from its icy bonds. The first blooms of the Snowdrop opened about the 14th, and the Crocus on the 19th, about six weeks later than in 1894. While the buds of deciduous trees and shrubs swelled rapidly toward the end of the month, they were equally late in comparison with the previous two years.

April.—Although favourable on the whole for outdoor work, the weather during the first half of this month was somewhat similar in character to that of March—generally dull, with sharp winds and coldish showers. After the 19th, it was much milder and more spring-like. As in the two years previous, there was a comparative absence of hard frosts during the month. Only 25° of frost were recorded on seven mornings, but, as indicating the

continued low range of temperature, the averages were 2° lower than in 1894, the maximum being 54° and the minimum 37°, against 56° and 39° respectively. The rainfall—1·05 inches—was somewhat less than in the corresponding month of the preceding year, while there was the same number (14) of dry days.

Beyond the ordinary variations by changes in the direction of the wind, the barometric readings were within a moderate range, the outstanding feature being a fall of an inch in the pressure within twenty-four hours. From 29·80 on the 5th the pressure fell to 28·80 on the 6th, when a sharp gale from the S.W. was experienced. The highest readings of the month were 30·10 inches, consecutively from the 12th to 15th, with N.E. winds. On nine occasions the winds were easterly, the S.W. winds predominating during the other days. Consequent on the absence of soft, warm weather, vegetation did not make very rapid growth, but as no serious check occurred, there was steady progress. Daphnes, Erythroniums, and *Dondia Epipactis*, Spreng., &c., were in bloom during the first week, while by the third week the White-flowered Rhododendron "Eugenie" and Hyacinths were plentifully in bloom, and were very satisfactory considering the severity of the winter.

May.—Although somewhat hard and dry in consequence of the prevalence of easterly winds, with the bright sunshine there was a marked improvement in the temperature, and despite the occasional high gusty winds, the weather throughout the month was pleasant and bracing. It was in striking contrast to that of the corresponding month in 1894, which was wet and unsettled, and signalised by a frost disastrous to vegetation. During the month no frost was recorded—an infrequent occurrence for May—consequently with the amount of sunshine enjoyed the average temperatures were higher than in the same month of 1894 by 5° on the minimum, and 8° on the maximum, the figures being 42° and 63° respectively. Four times during the month, viz., on the 7th, 28th, 30th, and 31st, the maximum thermometer in shade was above 70°. On the last-mentioned day it was 75°. The range of the barometric readings was moderate in extent. For several days during the first week the pressure was about 30·40 inches, and afterwards a steady decline took place until the lowest reading was reached on the 31st, viz., 29·50 inches.

Only a limited amount of rain fell (0·20 inch), there being 26 dry days. Slight thunderstorms occurred on the 23rd and 24th.

The leafing of trees developed rapidly during the first fortnight, and there was a fine display of bloom on most of the deciduous trees and shrubs, but the hard drying winds during the latter part of the month somewhat checked the growth for a time. The Oak leafed on the 6th, and the Ash on the 13th; the former being on the same date, and the latter four days earlier than in 1894. The note of the Cuckoo was heard on the 19th.

June.—For the first ten days the weather was warm and pleasant, with light easterly winds. The wind having thereafter changed both in direction and character, the weather became colder, and for about a week it was chilly in the mornings, when the thermometer registered below 40°. The latter part of the month was very warm and sultry, with occasional rains and thunderstorms. A thunderstorm of considerable severity was experienced on the 26th, but very little rain fell in and around the City during its occurrence. These conditions were reversed on the 28th and 29th, when the rainfall was heavy and the thunder more distant. The rainfall, 1·68 inches, was below the average—in fact before the 19th, when over half an inch fell, the amount recorded was but trifling. The wettest day of the month was the 28th, when 0·70 inch was registered.

The increase in the temperature noted for May was maintained, the average maximum being 66°, and the minimum 46°—in both cases higher than in the corresponding month of 1894. The 26th proved to be the hottest day of the year, when the thermometer, in shade, reached 78°—1° lower than the highest reading of 1894.

On ten occasions, chiefly during the latter part of the month, the thermometer, in shade, was at or above 70°.

With the hard dry winds and cold nights in the first half of the month no marked progress was made by vegetation, and tender subjects were much checked in growth; but with the rains and increased warmth after the 19th there was a decided improvement, and grass pastures, which were brown and bare for want of rain, rapidly assumed a verdant appearance.

July.—After a sharp thunderstorm on the 1st, the atmosphere became much cooler, and though several days were soft and balmy,

the weather generally, in consequence of its changeable character, was less pleasant than that of the preceding month. Squally winds and heavy showers were frequent, while at times the City was enveloped in fogs of a disagreeable, clammy nature. On the forenoon of the 24th the central parts of the City were enveloped in one of these fogs, which was as dense and disagreeable as those frequently experienced during frosty weather in winter, and though not cold it was equally unpleasant.

The rainfall was above the average, and 3·81 inches were registered, the heaviest fall on one day being 0·84 inch on the 27th. With the heavy rainfall the temperature was low for the season. Only on two occasions was the day thermometer up to 70°, while on the 27th and 28th the thermometer did not rise above 53°, which caused cheerless weather, and was unusual for July. The average maximum and minimum, 64° and 48°, were 4° and 2° lower respectively than in the corresponding month of 1894.

On the 2nd the barometric pressure was 29·30 inches, from which it rapidly rose to 30 on the 4th and 5th, and from that point it varied, with moderate changes, between 29·25 and 29·80 during the month. The winds were chiefly W. and S.W., and, as indicated, somewhat erratic and squally in force and duration.

Although the temperature was lower than usual for July, the moister atmosphere, after the heat of the preceding month, accelerated the progress of vegetation.

August.—With a predominance of S. and S.W. winds, August proved the wettest month of the year, the amount of rainfall registered being 6·02 inches. There were only five days on which no rain was recorded. Although the weather was wet and showery, the temperature was uniformly steady, no extremes being noted between the day and night readings. Only twice during the month was the maximum above 70°, while the minimum was only seven times below 50°, and that only to the extent of a very few degrees. The averages—maximum 65°, minimum 52°—were higher than in August, 1894, by 2° and 4° respectively.

The readings of the barometer, if somewhat irregular, were all within a moderate range, the pressure being lowest at 29·10 inches on the 4th, and highest at 29·95 on the 17th.

As the fairly high and steady temperature compensated for the abnormal rainfall, there was a gradual improvement in vegetation,

and many crops which were in a backward condition made excellent progress during the month.

September.—There was a marked difference in the character of the weather during September from that of the previous month. Despite two or three rainy days and occasional high winds, the weather throughout the month was comparatively dry and sunny, and almost as agreeable as the phenomenally fine weather which characterised September, 1894. The rainfall amounted to 1·40 inches, and there were 24 dry days. The temperature kept high, and the maximum thermometer in shade was at or above 70° on several occasions, while during the last week of the month, when the weather was close and sultry, that figure was reached three times. Only once during the month was the maximum below 60°, while the minimum was only once below 40°, something unusual for September. The averages, therefore, were high, the maximum being 63° and the minimum 49°, against 58° and 42° respectively for corresponding month of 1894.

On the night of the 9th a notable thunderstorm was experienced, when the display of sheet lightning was remarkably brilliant. This was followed by heavy rain and high winds for two days. It was on the occasion of that storm that the barometric readings showed any special depression, dropping from 29·87 on the 9th to 29·10 on the 11th. The rise in pressure was equally rapid, and, excepting a short sudden fall on the 18th, when another sharp gale was experienced, the pressure, with slight variations, was about 30 inches. The winds were from west and south-west all month, excepting the last two days, when they were easterly.

The fine weather experienced during the month proved very beneficial to all crops, and harvesting operations were seldom checked. The grain crops generally were secured in excellent condition throughout the country.

October.—After the 1st, which was warm and foggy, there was a sudden and severe change in the weather. With a change in the wind from east to west the barometer sharply fell from 29·50 on the 1st to 28·80 on the 2nd, and rain set in, falling heavily on the 2nd and 3rd, and continuing almost daily until the 16th; thereafter, until the end of the month, the weather was more settled, but colder.

The amount of rainfall recorded was 2·95 inches, while there

were only 13 dry days in the month. After the drop on the 2nd, the barometric pressure gradually increased, with slight variations, until the 17th, when it stood at 30·25 inches, falling steadily from that point until the 24th and 25th, when it was at 29·20, thus showing a fairly wide range over the month's readings.

With the rainfall in the first fortnight there was a rapid decline in the temperature, and frosts occurred nearly every morning after the 16th. The lowest reading was on the 28th, when 11° of frost were registered. The total amount of frost recorded was 75°, occurring on thirteen days. Snow to the depth of 1½ inches fell on the 26th, but it soon melted. The average maximum temperature was 49°, and the minimum 34°, or 2° lower in each case than those of October, 1894. During the month westerly winds prevailed, inclining northward on ten days.

With the frosts of the month the deciduous trees, which had retained their foliage longer than usual, rapidly cast their leaves, and assumed the bare appearance natural to the winter season.

November.—With the winds easterly the weather was dry and frosty for the first five days, during which time the City was more or less enshrouded in a pall of dense, disagreeable fog. The wind changed to the south-west from the 6th until the 17th, when there was a succession of heavy rains, showers of hail, and severe gales, which made the weather conditions extremely unpleasant. After the 17th the weather was less stormy, and of a soft, mild character. During the stormy fortnight the winds were chiefly from the south-west, but for sixteen days they were of a light description from the east, with a tendency northwards towards the end of the month. Rain to the amount of 4·08 inches was recorded, falling on 21 days. The barometric readings show very erratic changes, with a wide range over the month. The pressure varied from 28·60 on the 12th, which was the lowest reading during the stormy weather, to 30·20 inches on the 24th, when the air was clear and bracing for a few days.

The thermometer was at or below 32° on five mornings, and the amount of frost recorded was 22°. The average maximum or day temperature was 45°, and the minimum or night 36°, or 3° and 2° lower than those of the previous November.

December.—On the 1st there was a renewal of the westerly gales, and these continued with more or less severity during the

first half of the month, the weather being extremely changeable and disagreeable, with cold sleety rains. On the 3rd a sharp thunderstorm occurred, followed by a heavy rainfall. Over an inch of rain fell on the 4th, and fully three-fourths of an inch on the 5th. The heavy rainfall so flooded the rivers that a considerable amount of injury was done to the banks of the Clyde opposite Glasgow Green, while a severe westerly gale on the 5th so kept back the water that the works at the new weir were seriously injured. During the gale a steam crane with scaffolding, used in the erection of the new East-End Halls, or People's Palace, on the Green, was blown down and smashed, displacing in its fall a large portion of the masonry. After the 14th, the wind having veered eastwards, the weather was more settled and dry, with occasional frosts. As fogs frequently accompany frosts in the City, on the 20th one of particular density was experienced. Cold N.E. winds prevailed for a few days before Christmas, and on the 24th considerable damage was done to shipping by a severe gale, while the Anchor Line steamship "Furnessia" was delayed six days on her voyage home from America by the gales. There was a heavy fall of snow on the 28th, which rapidly disappeared under the influence of a S.W. wind which sprang up on the 29th. The closing days of the year were very mild and wet.

The rainfall amounted to 4·49 inches, and there were 15 dry days. From the 1st until the 14th the winds were chiefly from the west and south-west, and thereafter until about the end of the month from the east and north-east.

As in November, the readings of the barometer show erratic changes in the pressure, many being sudden and sharp. The lowest readings were on the 13th and 16th, when the pressure was 28·60 inches, and the highest was 30·10 inches on the 29th, while during the last days of the year it was at 29·50.

Frost occurred on thirteen days, the amount registered being 51°. The average maximum temperature was 40°, and the minimum 32°, the former is 4° and the latter 2° lower than the averages for December, 1894.

With regard to the rainfall of 1895, it is below the average of the past twelve years. Only twice during that period has a less amount been recorded. The amount registered for the year is 27·57 inches, falling in 153 days, while in 1894 the amount was

41·48 inches, on 196 days—a somewhat striking difference. There is an equally marked contrast in the periods during which it fell compared with the previous year. In 1894 over 17 inches were registered during the first three months, whereas in the corresponding months of 1895 the amount was less than 2 inches. The heaviest rainfall for one day in 1894 was 1·45 inches, which occurred on 27th January, and over an inch was recorded on three occasions during that year. Only on one day, however, in 1895, viz., 4th December, was the amount over an inch, when 1·03 inches fell. The wettest month of 1894 was February, when the exceptionally large amount of 8·96 inches of rain fell, whereas in 1895 August had the greatest rainfall, with 6·02 inches. It may be noted that for a series of years there has been a heavy rainfall in August.

As already stated, these notes are based on the records taken at Queen's Park, but the following table of the rainfall recorded in the other Parks, where gauges are now placed, shows interesting points of comparison; due allowance being made for the altitude, exposure, and other local conditions, as in no two cases are they alike :—

RAINFALL DURING 1895 IN THE PUBLIC PARKS.

	QUEEN'S.	MAXWELL.	KELVINGROVE.	SPRINGBURN.	ALEXANDRA.	GLASGOW GREEN.
Height of Gauge above Sea-level.	145 ft.	69·1 ft.	48·3 ft.	361 ft.	141·4 ft.	34·7 ft.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
January,	0·58	1·10	1·24	1·09	1·04	1·30
February,	0·14	0·04	0·00	0·00	0·06	0·28
March, ...	1·17	2·34	2·06	2·96	2·16	2·44
April, ...	1·05	1·88	1·75	1·97	1·40	1·71
May, ...	0·20	0·45	0·52	0·73	0·76	0·76
June, ...	1·68	1·84	2·11	2·43	2·14	2·08
July, ...	3·81	3·71	3·96	4·34	3·90	3·78
August, ...	6·02	5·69	5·96	6·86	6·69	6·45
September,	1·40	1·74	1·26	1·72	1·16	1·35
October, ...	2·95	4·51	3·50	3·33	3·31	3·28
November,	4·08	4·70	4·64	4·65	4·15	4·28
December,	4·49	4·21	4·84	4·18	3·93	4·80
Totals, ...	27·57	32·21	31·84	34·26	30·70	32·51

In reference to temperature, the mean is lower than those of the two previous years. The prolonged severe frosts in the early months, and the sunless wet months in the latter part of the year, may account for that. The only months which had high mean average temperatures were May, June, August, and September. The mean for the year was 45°, or 1° less than that for 1894, which was also 1° lower than its predecessor. The highest reading of the thermometer in shade was 78° on the 26th June, which was 1° lower than the highest of 1894. The thermometer was at or above 70° four days in May, ten in June, two in July, two in August, and five in September, or twenty-three times in all, as compared with nineteen times in 1894. The lowest reading was on the 10th February, when the minimum thermometer fell to 2° below zero, or 34° of frost. The amount of frost registered throughout the year was 823°, occurring on 99 days, and the coldest month was February, when frost was registered every morning. In 1894 January was the coldest month, and the total amount of frost registered on 55 mornings was 256°. The following comparative table of records taken at different Parks is of interest, as this is the first occasion on which it has been possible to compare them. As is the case with the preceding table of rainfall, allowance must here also be made for local conditions:—

1895.	Queen's Park.	Maxwell Park.	Kelvingrove Park	Springburn Park.	Alexandra Park.	Glasgow Green.
Thermometer.						
Highest reading of year, ...	78° on 26th June	87° on 8th June	84° on 7th June	75° on 27th June	80° on 8th June	82° on 7th June
Lowest do. do., ...	0·2° on 10th Feb.	0·3° on 10th Feb.	4° on 10th Feb.	4° on 10th Feb.	3° on 10th Feb.	1° on 10th Feb.
Number of days on which thermometer fell to freezing point (32°),	104 days	135 days	103 days	146 days	117 days	102 days
Number of days on which maximum thermometer did not rise above freezing point (32°), ...	20 days	17 days	27 days	51 days	20 days	18 days
Degrees of Frost registered—						
January, ...	273° on 29 days	304° on 29 days	173° on 24 days	314° on 30 days	287° on 27 days	235° on 26 days
February, ...	354 " 28 "	386 " 26 "	236 " 21 "	384 " 28 "	354 " 27 "	317 " 25 "
March, ...	32 " 8 "	46 " 10 "	19 " 6 "	68 " 16 "	29 " 7 "	22 " 6 "
April, ...	25 " 6 "	44 " 7 "	12 " 3 "	44 " 9 "	33 " 7 "	17 " 6 "
May, ...	...	8 " 4 "	...	...	...	...
June, ...	...	6 " 3 "	...	...	...	...
July, ...	...	...	...	...	...	...
August, ...	...	...	...	...	...	...
September, ...	...	2° on 2 days	...	...	...	...
October, ...	68° on 12 days	144 " 16 "	75° on 12 days	108° on 14 days	81° on 13 days	75° on 13 days
November, ...	20 " 4 "	49 " 10 "	27 " 8 "	56 " 12 "	31 " 7 "	13 " 3 "
December, ...	51 " 12 "	82 " 15 "	84 " 19 "	151 " 25 "	55 " 15 "	46 " 16 "
Totals, ...	823° on 99 days	1071° on 122 days	626° on 93 days	1125° on 134 days	870° on 103 days	725° on 95 days

In comparing the barometric records with those of the previous year, we find that the pressure has been somewhat lower. In 1894 the pressure was over 30 inches on eighty-one days, and under 29 inches on eighteen days; whilst during 1895 it was only sixty-four times above 30 inches, and twenty-six times below 29 inches. As in the previous two years, the highest reading was 30·40 inches, which occurred on 2nd January, and 3rd, 4th, 6th, and 7th May. The lowest reading was 28·50 inches on the 28th March, while in 1894 the lowest was 28·40 on 25th October.

The points from which winds blew throughout the year were as follows:—From the S.W., 96; N.E., 79; W., 77; E., 41; S., 29; N.W., 29; S.E., 10; and N., 4 days. Excluding the direct north and south, the western group shows 192, and the eastern 130 times. In 1894 the western had 205, against 138 for the eastern group.

Summarising the foregoing notes, the weather of 1895, compared with that of the preceding year, was, in many respects, of a totally divergent character. For example, the early months of 1894 were characterised by a heavy rainfall, and a comparative absence of frost, with many sunless days, whereas, in 1895, the frost was intense in January and February, while the rainfall of the first seven months was less than the amount which fell in February, 1894. Further, during May there was an entire absence of frost, and the many days of bright sunshine were in marked contrast to the conditions experienced in the corresponding month of 1894, when the weather, besides being sunless and unsettled, was accompanied by a disastrous frost. The conditions approaching in similarity were the rains in August, and the heat in September, followed by stormy unsettled weather in the closing months of the year.

Apart from the damage done to trees, shrubs, &c., by the frosts of January and February, the season on the whole was favourable for vegetation. The soil being well pulverised by the action of the frost, the tilling and cropping operations were accomplished under satisfactory conditions, on account of the favourable weather which prevailed when these operations were performed. Progress in growth, however, was somewhat slow owing to the prevalence of the drying winds and heat during May and June, and until the rain in July some anxiety was felt for

the crops. The growth, thereafter, was so satisfactory that most crops made a full average, and were harvested in good order generally, except on thin, poor soils, where the plants got stunted. The hay crop was the notable exception in regard to bulk. In many instances the second cutting was superior in bulk and quality to the first; the harvesting of this crop along with the cereals was frequently seen during September.

The effects of the intense frost on vegetation were most marked on evergreen shrubs and plants of succulent growth. The amount of loss suffered by nurserymen and others was very considerable, in many places whole breadths of plants were killed or seriously crippled. A plant nursery after a severe winter provides object-lessons of great value and extreme interest to those whose province it is to study the planting of trees and shrubs. Many problems difficult of solution present themselves. Frequently in a batch of plants of the same species isolated plants are found uninjured, whilst the others are killed. Not infrequently during last season cases were noticed of trees of a century's growth, which had withstood greater frosts than those of last winter, being severely crippled, while younger plants of the same species, growing comparatively near them, entirely escaped injury. It was noticed, also, that in many instances this state of matters was reversed.

As the effect of the severe frost on shrubs in our Parks may prove of service to those citizens who take an interest in such matters, it may be useful to note a few examples. For instance, the common *Rhododendron ponticum*, Linn., suffered more severely than the fine coloured hybrid varieties; while the hardiest of all appears to be a variety which thrives admirably about Glasgow, viz.:—*R. ponticum*, Linn., var. *Cunninghami*. The lesson taught by the Rhododendrons is obvious. Regarding Hollies, the broad-leaved sorts are the only ones now planted in quantity, as they withstand the impure atmospheric conditions better than the variegated or fancy-leaved ones, and these, while they were not killed, suffered serious defoliation, and were much weakened in consequence. In the case of Aucubas, only the few fancy varieties were killed outright. The well-known *Aucuba japonica*, Thunb.—though the foliage and sappy growths were severely blackened—recruited wonderfully during the season. Amongst the hardy heaths the majority of the foreign species stood better than our

native ones, which were "hard hit" in many places, and the common Whin and Broom also suffered severely. In all these species old plants suffered more injury than young ones. In Kelvingrove Park a border of comparatively little-known plants was formed in the spring of 1894. Amongst the subjects planted the following have had experience of the winter's vicissitudes, and have every appearance of succeeding under the adverse conditions of a soot-laden atmosphere, viz.:—*Azalea mollis*, Blume; *Berberis stenophylla*, Hance; *B. Darwinii*, Hook.; *Bambusa Metake*, Siebold; *B. Simoni*, Carr.; *B. violascens*, Carr.; *Daphne collina*, Smith; *D. fioniana; Escallonia Philippiana*, Engl.; *Genista præcox; G. Andreana; Gaultheria Shallon*, Pursh; *Ilex crenata*, Thunb. *(Fortunei); Ledum palustre*, Linn.; *Magnolia Soulangiana*, *Nuttallia cerasiformis*, *Olearia Haastii*, Hook.; *Osmanthus illicifolius; Pernettya mucronata*, Gaudich.; *Phillyrea decora*, Boiss. & Bal.; *Rhus Cotinus*, Linn.; *R. typhina*, Linn.; *Rhododendron ferrugineum*, Linn.; *R. hirsutum*, Linn.; *R. Wilsonianum; Skimmia japonica*, Lindl.; *S. oblata*, T. Moore; and *S. Foremani*. Several interesting plants were killed outright or cut down to the ground. Of these the following may be named—*Aristotelia Macqui*, L'Hérit. *(foliis variegatis); Azara microphylla*, Hook.; *Berberis Jamiesoni*, Turcz.; *Calycanthus floridus*, Linn.; *Colletia bictonensis*, Lindl.; *C. horrida; Genista hispanica*, Linn.; *Hypericum patulum*, Thunb.; *Magnolia purpurea*, Curt.; *Rhus glabra*, Linn., var. *laciniata; Rhododendron fragrans; Staphylea colchica*, Stev.

Very few of the deciduous trees and shrubs were injured; and, in their season, many bloomed in rich profusion, notably the various forms of Cerasus, Prunus, Pyrus, Deutzia, Viburnum, Weigela and several others. The notable exceptions were Laburnums and Hawthorns, which could hardly be expected to show much blossom after the extraordinary display of the previous year.

The growth made by trees and shrubs during the season is generally of a satisfactory nature, and prospects of a good bloom during the coming season are promising. With favourable weather a rich floral display may be expected in our parks and woodlands, and it is to be hoped that an abundant crop of fruit will be secured in gardens and orchards.

Subjoined is the Meteorological Record for the last three years, as kept at Queen's Park, and the averages for the last twelve years.

COPY OF METEOROLOGICAL RECORD KEPT AT QUEEN'S PARK, GLASGOW.

Rain Gauge 145 Feet above Sea Level.

MONTHS.	1893.				1894.				1895.				Averages for the Last 12 Years.					
	Rainfall.	Thermometer. Average.		Dry Days.	Rainfall.	Thermometer. Average.		Dry Days.	Rainfall.	Thermometer. Average.		Dry Days.	Years.	Rainfall.	Mean Temperature.	Dry Days.	Number of Days on which 1° or more of Frost was registered.	Degrees of Frost registered.
	Inches.	Max.	Min.		Inches.	Max.	Min.		Inches.	Max.	Min.			Inches.				
January,	1·14	40	32	17	4·87	42	31	10	0·58	34	23	21	1884	40·54	47	192	58	195
February,	2·94	45	34	8	8·96	44	34	6	0·14	35	19	23	1885	28·70	46	200	62	361
March, ...	0·74	52	35	19	3·37	52	34	16	1·17	47	35	15	1886	29·96	46	194	97	518
April, ...	1·11	58	38	23	1·91	56	39	14	1·05	54	38	14	1887	25·78	47	203	97	417
May, ...	3·28	61	45	18	2·28	55	38	14	0·20	63	43	26	1888	32·33	46	190	81	232
June, ...	2·40	68	49	23	2·76	63	45	14	1·68	67	46	21	1889	26·18	47	194	59	250
July, ...	2·19	67	51	18	2·71	69	50	19	3·81	64	49	15	1890	38·04	47	170	74	273
August,...	3·34	68	52	15	4·87	64	48	12	6·02	65	52	5	1891	36·09	46	184	85	371
September,	3·25	60	45	11	0·14	59	43	26	1·40	63	49	24	1892	33·84	45	194	101	798
October,	5·02	54	41	7	2·68	51	36	17	2·95	49	35	13	1893	33·05	47	186	56	306
November,	3·07	44	32	19	3·96	49	38	8	4·08	46	37	10	1894	41·48	46	169	55	256
December,	4·57	45	36	8	2·97	44	34	13	4·49	40	33	15	1895	27·57	45	202	99	823
	33·05			186	41·48			169	27·57			202	Averages.	32·80	46°	189	77	400°

JAS. WHITTON.

Meteorological Notes, and Remarks upon the Weather during the Year 1896, with its General Effects upon Vegetation.

By James Whitton, Superintendent of Parks, Glasgow.

[Read 29th June, 1897.]

From the subjoined notes on the weather of 1896, it will be observed that the past year presents an almost unprecedented record of inclemency. For some years past, observation has proved that the early months of spring have been the most reliable and uniform, so far at least as the West of Scotland is concerned.

January.—The weather throughout the month was somewhat unsettled, but, on the whole, open and mild. The first three days were dull and wet, then, until the 10th, with the winds easterly, it was dry and fine, with occasional frosts. A change of wind to the west, and a rapid fall of the barometer, brought another spell of disagreeable weather—cold rain, with frequent showers of snow and hail predominating. These conditions prevailed until the last week, when it became drier and milder.

The changes of the pressure were steady until the 9th, when the barometer, having risen to 30·78, rapidly fell until the 15th, when it was down to 28·80, betokening the sharp N.W. gale, with snow and sleet, which was experienced. The changes were afterwards irregular, with an upward tendency towards the end of the month. The amount of rain which fell was only 1·54 inches, and there were eighteen dry days. Frost was registered on twelve days, but the total amount was only 55°, a marked contrast to what was recorded in the corresponding month of the previous year, when a total of 273° was recorded on twenty-nine days. The average maximum temperature was 43° and the minimum 34°, whereas in January, 1895, they were 34° and 23° respectively.

The effects of the open weather on vegetation were very marked, the buds of many trees swelling early, while the Elder and Thorn were bursting at the end of the month. Christmas Roses (*Helleborus niger*, Linn.) were in full bloom all the month, and Snowdrops and Winter Aconite in the last week.

February.—The open weather which characterised January continued throughout this month. The barometric pressure was equally irregular, ranging from 30·35 on the 3rd to 27·80 on the 10th. The winds generally were of a moderate character, and came from the W. and S.W. in the early part, and easterly in the latter part of month. The rainfall was again light, only 1·76 inches being recorded, while there were nineteen dry days. The temperature was high, the average maximum being 47° and the minimum 36°, while the amount of frost was only 26° on six mornings. In February, 1895, frost was registered every day of the month, to the amount of 356°.

The continued mild weather naturally had the effect of forwarding vegetation. *Rhododendron præcox*, Davis, *R. Nobleanum*, Hort., and *Daphne Mezereum*, Linn., were in bloom by the middle of the month, while the buds of Elms, Acers, Pyri, Chestnuts, &c., were at bursting point. Hepaticas, Polyanthus, and Crocus were blooming in the second week, and full before the end of the month.

March.—With a prevalence of westerly winds, the weather during the month was changeable, with frequent gales and heavy rain. On the 3rd there was a fall of snow to the depth of about 5 inches, which rapidly disappeared under the influence of strong westerly winds. Towards the end of the month the weather became more settled, and several fine days were experienced. The barometric readings were very irregular, the most notable drop being on the 3rd, when the pressure fell to 28·20 inches. The average pressure was low, as on no occasion did it reach 30 inches.

The rainfall was somewhat heavy, 4·21 inches being recorded. On the 16th the large amount of 1·08 inches fell. The average temperature was low owing to the absence of sunshine, and was very similar to that of the corresponding month of last year, 46° being the average maximum and 34° the average minimum. The amount of frost (31°) and the number of days (ten) on which it occurred,

curiously enough, almost exactly coincide with the registrations of 1895.

Owing to the absence of any check, vegetation continued to advance rapidly. Heaths, Narcissi, *Dondia Epipactis*, Spreng., and Dog's-tooth Violet (Erythronium) were in full bloom within the first fortnight, and by the third week Rhododendron Eugenie and Scillas were abundant. The Balsam Poplar was in leaf, and many other trees were in an advanced state—in many cases a month earlier than in 1895.

April.—Fine weather was experienced during the first week, after which, for ten days, it was changeable and much colder, with showers of hail and sleet. The latter half of the month was fine on the whole, though changeable towards the end. There was thunder on the 29th.

There were twenty dry days in the month, and the rainfall amounted to only 1·83 inches. The readings of the barometer showed a fairly steady pressure, varying from 30·20 inches to 29·40 inches, with no sudden changes, whilst the winds were from N.W. to S.W., excepting four days, when they were easterly.

The comparative absence of frost, which has been somewhat remarkable of late years in April, was even more noticeable this year, as the thermometer was at or below freezing point (32°) on three mornings only, the total amount of frost recorded being 7°. The temperature was slightly higher than in the corresponding month of the previous year, the average maximum being 56° and the minimum 38°, against 34° and 27° respectively in 1895.

With a continuance of the open weather which characterised the previous month, vegetation, which was abnormally early, made rapid progress. During the first week, leaves appeared on the Alder, Birch, Elm, Sycamore, Rowan, and Horse Chestnut, while *Berberis dulcis*, Sweet, *B. Aquifolium*, Pursh., *Kerria japonica*, DC., Ribes (of sorts), Rhododendron Eugenie, were in full bloom; and by the end of the month many others, notably the Geans, had blossomed profusely.

May.—The weather experienced throughout the month was delightful. The barometric readings were high, with slight variations. Excepting for a few days after the 18th, when we had rain, the pressure was between 30 and 30·30 inches.

There were light winds from the N.E. and N.W., and the rainfall was limited in amount to only 0·60 inch, of which 0·40 inch fell on the 18th. There were twenty-eight dry days. This month was very similar to May, 1895, the chief feature being the very limited rainfall. On three days the maximum temperature in the shade was over 70°, and only on six days was it below 60°, while the minimum was only four times slightly under 40°. Consequently the average temperature was high for the month, the maximum being 63° and the minimum 43°. The fact that no frost occurred in May has again to be noted.

With the bright sunshine and the absence of frost, vegetation, already abnormally forward, received no check; and there was a wonderful development of leaf and growth during the month. The Oak was in leaf on the 3rd and the Ash on the 12th, both being slightly earlier than in 1895. Hawthorn, Laburnum, Bird Cherry, and Horse Chestnut were in bloom by the 12th, also *Rhododendron Cunninghami*, Hort., and *R. ponticum*, Linn. The cuckoo was heard on the 11th, or eight days earlier than in 1895.

June.—After the 1st, which was a dull though otherwise a fine day, the wind changed to the N.E., and for fully a week thereafter the weather was dull and showery. Thunderstorms occurred on the 4th and 8th, after which the weather was fine and warm. Although, after the 15th, westerly winds prevailed and several days were showery and ungenial, the readings of the barometer showed that the pressure was fairly steady, the lowest point being 29·30 on the 17th, when heavy rain fell during the early part of the day, and the highest points on the 26th and 29th, when 30 inches were recorded. The rainfall was above the average, 4·07 being registered—the greatest amount for one day was 0·94 inch, which fell on the 4th. There were sixteen dry days. The highest day temperature in the shade was 78° on the 16th. This temperature is the same as that of the hottest day of 1895, viz., 26th June. The average maximum temperature was 65° and the minimum 49°, the former being 1° less and the latter 3° more than that of the corresponding month of 1895.

The rains in the early part of the month, after the warmth of May, gave an impetus to vegetation, and the development in growth was exceptional; in fact, such quality of foliage on trees

about the City is rarely obtained. The grass fields, which were browned by the drought of May, rapidly recovered and assumed a verdant appearance.

July.—With a prevalence of S.W. winds, the weather was changeable and showery, but, on the whole, the atmosphere was mild and pleasant, though it became much colder towards the end of the month, consequent on the cooling effect which heavy rains had on the air. The barometric pressure was within a moderate range, varying from 29·80 on the 1st to 29·50 on the 9th, when we had a very heavy rainfall; then it rose to 30·06 on the 16th, 17th, and 18th, when fine weather was experienced; after which the barometer steadily fell to 29·40 on the 26th. From that date the changes were erratic.

As in the corresponding month of the previous year, the rainfall was above the average; the amount registered was 3·92 inches, with nineteen dry days. On four days of the month the rainfall was heavy, when over half an inch fell within each twenty-four hours; the heaviest fall occurred on the 9th, when 1·22 inches were registered.

On account of the heavy rainfall, the temperature was not high, the average maximum being 64° and the average minimum 49°—the former the same as in July, 1895, and the latter 1° higher.

The moist, warm atmosphere had the natural effect of causing luxuriant growth on vegetation, especially on grass, whilst there was a paucity of bloom on summer bedding plants.

August.—For three weeks the weather was good (some days in fact were remarkably pleasant), but towards the end of the month it became unsettled and more akin to what was experienced in August of the two previous years.

The temperature, however, was somewhat lower than in the preceding year, the average maximum being 63° and the minimum 48°—the same as in 1894—but 2° in the maximum and 4° in the minimum lower than in 1895. As a comparison it may be stated, that while in August, 1895, the maximum day temperature was twice above 70°, the nearest approach to that point last August was 68° on the 12th, while the minimum or night temperature was only ten times above 50°, whereas in 1895 it was twenty-four times above that point. However, though the temperature

was lower, the weather was drier, as the rainfall amounted only to 1·64 inches with twenty dry days, against 6·02 inches and five dry days in August, 1895.

With the winds northerly in the beginning of the month, the barometric chart showed that the pressure was moderately high and steady. From 29·82 inches on the 1st it increased to 30·10 on the 10th, afterwards keeping below that with slight irregularities throughout the month. The lowest point was 29·40, which occurred on the 26th and 30th. The bright weather at the beginning of the month tended to ripen the grain crops, and harvesting operations were begun by the middle of the month, but these were sadly retarded by the unpropitious weather which prevailed towards the end. The stormy weather had its effect on the trees in the City Parks, as the leaves of the Birch, Beech, Limes, and Poplars began to fall rapidly during the latter part of the month.

September.—The stormy weather which prevailed in the latter part of August continued with more or less severity nearly throughout this month, and the weather was in striking contrast to what was experienced in September, 1894 and 1895, when it was exceptionally dry and warm; in fact, after the first week, when we had five dry days, the weather was unusually boisterous and wet for the season of the year. Rain fell to the amount of 4·71 inches, and there were only ten dry days. While the winds were chiefly from the N.E. and light in force during the first fortnight, thereafter they became strong and squally, increasing at times to gales, one of which was experienced on the 17th.

The barometer was steady till the 7th, when it indicated 29·90 inches, but after the 9th the pressure was very erratic, with sharp changes, notably from 29·10 on the 15th to 29·85 on the 16th. The lowest readings were 28·90 on the 25th and 26th, and the highest 30·10 on the 30th.

Owing to the wet, tempestuous weather, the temperature was low, the average maximum being 59° and the minimum 46°, or 4° and 3° respectively lower than in the previous September.

Consequent on the wet stormy weather, harvesting operations were much interrupted; and considerable damage was done to crops throughout the country, as the stormy conditions were not local. The vegetation in our City Parks was much weather-beaten by

the middle of the month, the leaves of the Alder, Hawthorn, Oak, Pyrus, Willow, &c., falling quickly.

October.—During the first ten days there was a continuance of wet, stormy weather, with a severe gale accompanied by heavy rain on the 8th. After the first frost of the season, on the 11th, when 3° of frost were registered, the weather became somewhat settled but very cold, with a considerable amount of frost for October. Snow and sleet fell on the 24th.

The rainfall was rather above the average, the amount registered being 3·70 inches. There were seventeen dry days. The winds, which were westerly and strong for the first ten days, were lighter and northerly afterwards.

Throughout the month the readings of the barometer show a series of erratic changes with a greater range than usual. From 30·12 inches on the 1st the pressure fell to 28·60 on the 8th, rising again to 30·25 inches on the 14th. Then it fell to 29·98 on the 18th, till on the 31st it stood, with several sharp intervening changes, at 29·64 inches, thus showing a range of nearly 1½ inches during the month.

The average day temperature was 48° and the minimum of night temperature 34°, the former being 1° less than and the latter the same as in the corresponding month of 1895. Frost to the amount of 56° was registered on thirteen mornings. With the frost of the month, vegetation rapidly assumed a wintry appearance; most of the deciduous trees and shrubs being divested of the bulk of their leaves by the end of the month.

November.—Throughout the month the weather was open and mild on the whole, and remarkably fine for the season. An absence of sunshine, a prevalence of fogs with little frost, and a rainfall of limited amount being its chief characteristics. The winds were generally of a light description, W. and S.W. in the early part, and N.E. during the last week. The amount of rain registered was only 1·07 inches, and there were twenty dry days. Frost occurred on ten mornings, but the total amount registered was only 50°, the only severe occasion being the 30th, when 12° were recorded. The average maximum temperature was 46° and the minimum 35°, or 1° higher and 1° lower respectively than in November, 1895.

The records of barometric pressure show a varied course

which are most striking about the middle of the month, when a sharp rise from 28·95 on the 15th to 29·70 inches on the 16th occurred. The highest readings were on the 5th, 24th, 25th, and 26th, when the pressure indicated was 30·30 inches. The lowest reading was 28·95 on the 15th.

As exemplifying the mildness of the weather which characterised November it may be stated that that precocious plant, *Jasminum nudiflorum*, Lindl., began to open its flowers at the beginning of the month, several weeks earlier than usual.

December.—The weather during this month was very varied in character. Sharp touches of frost, heavy rains, northerly winds, and an absence of sunshine, combined to make the atmospheric conditions very trying and often disagreeable.

During the first two weeks rains were intermittent and moderate in quantity, but, after a week of dry frosty weather, heavy rain fell on the 24th and daily thereafter until the end of the month. The amount of rain which fell was 4·85 inches, of which 1·08 inches fell on the 30th. There were thirteen dry days. In December, 1895, the rainfall was 4·49 inches, and there were fifteen dry days.

With the heavy rainfall and frequent frosts the temperature was low. The average maximum was 40°, and the minimum 31°, the former being the same as and the latter 1° lower than in the corresponding month of 1895. The thermometer was at or below freezing point on seventeen mornings, while the total amount of frost registered amounted to 95°. The hardest frost occurred on the 18th when 14° were registered.

The barometric readings show a less erratic range of pressure than what obtained in November. From 29·73 on the 1st the pressure fell steadily to 28·65 inches on the 6th, after which it rose steadily, after a heavy rainfall on the 7th, to 30 inches on the 20th and 21st, which was the highest indicated for the month. There were sharp changes during the stormy days of the last week, and at the close of the year the atmospheric pressure was 29·46 inches.

Plants of the Christmas Rose (*Helleborus niger*, Linn.) began to open their flowers during the first week and were in full bloom by the 20th, while *Jasminum nudiflorum*, Lindl., which had been flowering early in November, was in full bloom during Christmas week.

Comparing the records with those of the previous year, we find that the rainfall was somewhat greater, the total amount registered for the year being 33·90 inches, against 27·57 inches registered in 1895, which, however, was below the average of the previous twelve years. The wettest month of the year was December, when 4·85 inches were registered. In 1895 August was the wettest month, when the rainfall amounted to 6·02 inches. The greatest amount recorded for one day was 1·22 inches (July 9th). On 16th March the amount was 1·08 inches, and the same was recorded on 30th December. The heaviest rainfall for one day in 1895 was 1·03 inches on the 4th December.

As in 1895, May proved the driest month of the year. The number of dry days in the year was 209, against 202 days in 1895.

The following table shows the amount of rainfall registered in the Parks where gauges are placed, in comparison with that of Queen's Park, on whose records these observations are based. Regarding this table and those which follow, it must be borne in mind that due allowance requires to be made for altitude and exposure, and other local conditions :—

RAINFALL DURING 1896 IN THE PUBLIC PARKS.

	QUEEN'S.	MAXWELL.	KELVINGROVE.	SPRINGBURN.	ALEXANDRA.	GLASGOW GREEN.
Height of Gauge above Sea-level.	145 ft.	69·1 ft.	48·3 ft.	361 ft.	141·4 ft.	34·7 ft.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
January,	1·54	1·86	2·20	2·29	1·81	2·14
February,	1·76	1·66	1·10	2·35	1·60	1·63
March, ...	4·21	4·07	4·45	4·56	3·93	4·54
April, ...	1·83	1·85	2·18	2·63	2·08	2·16
May, ...	0·60	0·72	0·73	0·94	0·84	0·95
June, ...	4·07	5·72	4·23	4·72	4·46	4·94
July, ...	3·92	3·17	3·94	3·93	4·04	4·08
August,...	1·64	1·81	1·96	1·94	1·45	1·53
September,	4·71	4·59	4·92	4·26	4·68	4·13
October,	3·70	4·34	3·69	3·16	3·16	3·04
November,	1·07	1·21	1·34	1·41	0·99	0·40
December,	4·85	4·64	4·48	4·59	4·10	3·90
Totals,...	33·90	35·64	35·22	36·78	33·14	33·44

With reference to the temperature, there was a greater uniformity in the monthly averages, and the mean (47°) is two degrees higher than that of 1895, when greater extremes of temperature were experienced. The warmest month of the year was June, but its average temperature (57°) was two degrees lower than that of August, 1895, which was the warmest and wettest month of that year. The highest reading of the thermometer in shade was 78° on the 16th June, which was also the highest reading for the previous year and occurring in the corresponding month. The same thermometer was at or above 70° on three occasions in May, eight in June, five in July, or sixteen times in all, against twenty-three times in 1895. A similar absence of extremes is found on comparing the register of the minimum thermometer in shade, which was at or below freezing point on seventy-three days, as against a hundred and four times in 1895. The greatest amount of frost registered on one day was 14°, this occurring twice, viz., on the 23rd January and the 20th December, a marked contrast to the lowest readings of the previous year, when on the 10th February 34° frost, or 2° below zero, were registered. The coldest month was December, when a total of 95° of frost was recorded on fourteen mornings. January was the coldest month of 1895, when, on twenty-nine days, the amount of frost was 373°. During the year the total amount of frost was 331°, occurring on sixty-three days. In 1895 the amount was 823° in ninety-nine days.

The following table, like that of the rainfall, shows several interesting features of comparison :—

1896.	Queen's Park.	Maxwell Park.	Kelvingrove Park.	Springburn Park.	Alexandra Park.	Glasgow Green.
Thermometer.						
Highest reading of year, ...	78° on 16th June	81° on 16th June	74° on 15th June	73° on 15th June	82° on 16th June	87° on 14th June
Lowest do. do.,	18° on 23rd Jan. and 20th Dec.	14° on 20th Dec.	18° on 20th Dec.	15° on 23rd Jan.	17° on 20th Dec.	16° on 20th Dec.
Number of days on which thermometer fell to freezing point (32°),	73 days	104 days	105 days	137 days	90 days	85 days
Number of days on which thermometer did not rise above freezing point (32°), ...	5 days	9 days	18 days	12 days	3 days	3 days
Degrees of Frost registered—						
January, ...	55° on 11 days	93° on 13 days	69° on 13 days	120° on 16 days	71° on 10 days	47° on 9 days
February, ...	26 " 5 "	38 " 8 "	33 " 9 "	70 " 12 "	28 " 7 "	23 " 7 "
March, ...	31 " 10 "	63 " 12 "	53 " 14 "	107 " 18 "	48 " 11 "	30 " 10 "
April, ...	7 " 2 "	31 " 8 "	17 " 6 "	45 " 11 "	14 " 4 "	8 " 3 "
May, ...	...	4 " 1 day	...	...	...	...
June, ...	...	...	...	...	..	...
July, ...	...	...	...	...	...	...
August, ...	...	...	...	...	...	...
September, ...	...	1° on 1 day	...	3° on 1 day	1° on 1 day	...
October, ...	66° on 13 days	102 " 15 days	85° on 17 days	120 " 19 days	83 " 14 days	74° on 15 days
November, ...	51 " 8 "	85 " 13 "	55 " 9 "	104 " 16 "	75 " 11 "	71 " 11 "
December, ...	95 " 14 "	166 " 20 "	120 " 17 "	204 " 25 "	115 " 19 "	104 " 17 "
Total frost registered,	331° on 63 days	583° on 91 days	432° on 85 days	773° on 118 days	435° on 77 days	357° on 72 days

The barometric readings show that the atmospheric pressure was somewhat higher than during the previous year. In 1895 the pressure was sixty-four times above 30 inches and twenty-six times below 29 inches, while in 1896 it was seventy-three times above 30 inches and only sixteen times below 29 inches. The highest reading occurred on the 9th January, when the pressure was at 30·78 inches; and the lowest reading was 28·20 inches on 3rd March—the highest slightly higher and the lowest slightly lower than on any occasion in 1895.

In reference to the winds: whilst these were squally enough at times, no gales of exceptional severity, such as were experienced in the preceding year, occurred. The points from which the winds came during the year were as follows:—From the S.W., 107; W., 107; N.E., 74; N.W., 31; E., 20; S.E., 14; S., 9; and N., 4 days. Excluding the direct North and South, the Western group shows 245 times against 108 times for the Eastern. In 1895 the Western had 192, and the Eastern 130 times respectively.

In comparing the notes regarding the weather of 1896 with those of the preceding year, very few points of similarity are found. In the early months of 1895, frosts of exceptional severity were experienced, causing serious hindrance to outdoor labour, whilst the injury to vegetation was very marked; whereas, in 1896, there was a comparative absence of frost, and the winter months were abnormally open and mild. Again, during the spring months, the freedom from frost was, as in 1895, very notable. For a series of years the month of August was more or less stormy and wet, followed later by fine sunny weather. These conditions, however, did not hold good last year, for, although the weather of August was on the whole good, it broke down during the last week; and the weather of September and October was of a most disagreeable character, which sadly interfered with harvesting operations throughout the country. The later months of the year were likewise stormy, with a remarkable absence of sunshine.

The favourable weather of the early part of the season naturally had its effect in forwarding vegetation, and, as no check was experienced, the development of leaf and growth was earlier than usual and of a finer character than what we are accustomed to in this district. There was a fine display of blossom on most trees

and shrubs, though the dry weather in May militated against the setting of fruits, and consequently the crops of large fruits were under the average in various parts of the country.

Although the grass lands suffered somewhat by the drought of May, the rains and warmth of June rapidly restored them, and there was an excellent crop of hay, which was generally secured in good condition. The cereals, which likewise were bulky in crop, were harvested with difficulty and frequently in bad condition, owing to unfavourable weather in September and October. The grain was consequently in many cases seriously damaged.

As already stated, the growth made by trees and shrubs during the season was of exceptional quality; and, in the case of deciduous sorts, there is every prospect of an excellent display of bloom in orchard and woodland for the ensuing season. The open wet weather of autumn, however, caused a secondary growth on many evergreen shrubs, and, as these growths are soft and succulent, their condition to resist frost is of a less satisfactory nature. It may be noted that, in the case of Rhododendrons, some varieties are unusually well set with flower buds whilst others are unusually barren. In our notes for 1895 we remarked that in the Parks many old plants were seriously crippled by the severe frosts of that year. In many instances the growth made since then has been so weak, showing that the vitality of the plants had gone, that we have been reluctantly forced to clear them away entirely.

Subjoined is the Meteorological Record for the last three years, as kept at Queen's Park, and the averages for the last twelve years.

COPY OF METEOROLOGICAL RECORD KEPT AT QUEEN'S PARK, GLASGOW.

Rain Gauge 145 Feet above Sea Level.

MONTHS.	1894.				1895.				1896.				Averages for the Last 12 Years.					
	Rainfall.	Thermometer. Average.		Dry Days.	Rainfall.	Thermometer. Average.		Dry Days.	Rainfall.	Thermometer. Average.		Dry Days.	Years.	Rainfall.	Mean Temperature.	Dry Days.	Number of Days on which 1° or more of Frost was registered.	Degrees of Frost registered.
	Inches.	Max.	Min.		Inches.	Max.	Min.		Inches.	Max.	Min.			Inches.				
January,	4·87	42	31	10	0·58	34	23	21	1·54	43	34	15	1885	28·70	46	200	62	361
February,	8·96	44	34	6	0·14	35	19	23	1·76	47	36	19	1886	29·96	46	194	97	518
March, ...	3·37	52	34	16	1·17	47	35	15	4·21	48	34	12	1887	25·78	47	203	97	417
April, ...	1·91	56	39	14	1·05	54	38	14	1·83	56	38	20	1888	32·33	46	190	81	232
May, ...	2·28	55	38	14	0·20	63	43	26	0·60	63	43	28	1889	26·18	47	194	59	250
June, ...	2·76	63	45	14	1·68	67	46	21	4·07	65	49	16	1890	38·04	47	170	74	273
July, ...	2·71	69	50	19	3·81	64	49	15	3·92	64	49	19	1891	36·09	46	184	85	371
August,...	4·87	64	48	12	6·02	65	52	5	1·64	63	48	20	1892	33·84	45	194	101	798
September,	0·14	59	43	26	1·40	63	49	24	4·71	59	46	10	1893	33·05	47	186	56	306
October,	2·68	51	36	17	2·95	49	35	13	3·70	48	34	17	1894	41·48	46	169	55	256
November,	3·96	49	38	8	4·08	46	37	10	1·07	46	35	20	1895	27·57	45	202	99	823
December,	2·97	44	34	13	4·49	40	33	15	4·85	40	31	13	1896	33·90	47	209	63	331
	41·48			169	27·57			202	33·90			209	Averages,	32·24	46°	191	77	411°

Reports on Excursions.

CRAIGALLIAN, MILNGAVIE, 12th September, 1896.—This was a joint-excursion with the Andersonian Naturalists' Society, and was well attended. The great size and abundance of fruits on shrubs and trees were much remarked. Nothing was noted worthy of being placed on record.

TYNINGHAME, EAST LINTON, 28th September, 1896 (Glasgow Autumn Holiday).—The Society, conjointly with the Andersonian Naturalists' Society and the Scottish Natural History Society of Edinburgh, made an excursion on this date to Tyninghame, near East Linton, the seat of the Earl of Haddington. The company numbered over fifty. Arriving at East Linton, the party was received by Lord Haddington. After a short time spent at the Old Mill in Prestonkirk Meadow, where some picturesque bits were photographed, the way was taken for Binning Wood. By the wayside a number of plants which are rare or uncommon in Clydesdale were noted. The list includes *Parietaria officinalis*, Linn., *Solanum Dulcamara*, Linn., *Papaver dubium*, Linn., *Lychnis vespertina*, Sibth., *Agrimonia Eupatoria*, Linn., *Hypericum perforatum*, Linn., *Scabiosa arvensis*, Linn., *Malva rotundifolia*, Linn., *Malva sylvestris*, Linn., and *Chenopodium Bonus-Henricus*, Linn. Binning Wood, planted about the year 1706, was devastated by the great storm of 1881, but is still very extensive, and contains many fine specimens of Beech, Scotch Fir, Silver Fir, Horse Chestnut, Spanish Chestnut, and Oak. Measurements were made of a number of trees; worthy of record being: a Spanish Chestnut, measuring 14 ft. 5½ in. in girth at 5 ft. from the ground, bole 18 ft.; and a Silver Fir, named "King of the Wood," 13 ft. 3 in. at 5 ft., bole about 12 ft., estimated height about 105 ft. Attempts have been made, by judicious planting, to repair the ravages of the storm both here and in the park. In one of the new plantations were seen some very fine varieties of Acers and Oaks. Arriving at the mansion, Lord Haddington

received the party, extended a hearty welcome, and invited them into the house, where luncheon was provided. On behalf of the company, Mr. A. Somerville, B.Sc., F.L.S., in fitting terms warmly thanked his lordship for his kindness and hospitality. After an inspection of an extensive collection of curios, antique and modern, an adjournment was made to the shrubbery, where Lord Haddington personally pointed out and described the more interesting shrubs. Here were noted fine examples of *Garrya elliptica*, Dougl., in catkin, and *Arbutus Unedo*, Linn., loaded with blossom and its remarkably beautiful muricated fruit, which was just beginning to colour. Upon the lawn two ancient Venetian well-heads in white marble, after the design of Corinthian capitals, carved with armorial bearings, were much admired. The ruins of the old church of Tyninghame, which was built about 700, and of which only two arches now remain, were inspected and photographs taken. Notwithstanding the fact that the season was so far advanced, the garden was still gay with Japanese Anemones, Begonias, Michaelmas Daisies, Golden-rods, and Torch Lilies (Kniphofias)—the last named, planted in great masses, presenting a gorgeous appearance. A beautiful specimen of the ornamental Japanese tree *Paulownia imperialis*, Sieb. and Zucc., attracted considerable attention. The trees measured near the house were as follows:—Cedar of Lebanon, planted in 1818, girth 8 ft. 2 in. at 5 ft.; Beech, 12 ft. 7½ in. at 5 ft., bole about 35 ft.; Spanish Chestnut, 13 ft. 2½ in. at 5 ft., bole about 30 ft.; Beech, west of house, 12 ft. 8½ in. at 5 ft.; Sycamore, broken, 20 ft. 5½ in. at 3 ft.; Spanish Chestnut, west of house, 14 ft. 2½ in. at 5 ft., bole about 24 ft.; Beech near Bowling Green, 13 ft. 3½ in. at 5 ft..

After votes of thanks the party returned to East Linton, where tea was served, and the return journey made, Glasgow being reached after midnight.

HAMILTON, 3rd October, 1896.—On this date the closing excursion of the season took place, jointly with the Andersonian Naturalists' Society, a party numbering about thirty representing the joint societies. Hamilton Palace grounds (the "Low Parks") were visited, and the attention of those present was directed chiefly

to fungi, of which 41 species were noted. Among those identified were *Agaricus* (*Flammula*) *sapineus*, Fr., *Ag.* (*Entoloma*) *jubatus*, Fr., which was very fine, *Ag.* (*Hypholoma*) *capnoides*, Fr., *Ag.* (*Hebeloma*) *subcollariatus*, B. & Br., *Ag.* (*Psilocybe*) *spadiceus*, Fr., *Lactarius serifluus*, Fr.

Campsie Glen, 27th March, 1897.—This was the opening excursion of the season, but the weather was unpropitious, very few members attended, and nothing was noted deserving of record.

Killin, 19th April, 1897 (Glasgow Spring Holiday).—On this date a joint-excursion with the Geological Society of Glasgow took place to Killin, a party of about twenty proceeding to the Pier Station at Killin. On the side of the road, and in the woods near Finlarig, several sections of rocks showing limestone overlying hornblende schist were examined.* The hornblende schist rock is believed to be of altered igneous formation. The dip of the beds here is to the north-west. In this vicinity a fine Spanish Chestnut measured 16 ft. 8½ in. in girth at 5 ft. from the ground, and had a bole of 9 ft. In the New Statistical Account (1843) the girth of the largest of four Chestnuts is given as 15 ft. 10 in. at 3 ft. from the ground. A Sycamore, west of the Spanish Chestnut, measured 13 ft. 5½ in. in circumference at 6 ft. from the ground, and had a bole of 10 ft. The grounds of Finlarig, the ancient seat of the Breadalbanes, and now containing the burying place of that family, were visited. Several trees had been blown down in the last great storm, and the trunk of the largest, a Sycamore, still lay on the ground. This tree measured 15 ft. in girth at about 6 ft. from the base of the trunk. In the New Statistical Account it is estimated as being probably 300 years old. At Killin Church is a fine Sycamore with a bole of 17 ft., and a girth of 10 ft. 3 in. at 4 ft. On this tree Sir William J. Hooker is said to have discovered the moss *Habrodon Notarisii*, Schpr., in 1830. This moss still grows on the upper part of the trunk of the

* See a paper by Mr. Peter MacNair "On the Altered Basic Rocks of the Highlands as exemplified by the Sill of Hornblende Schist underlying the Loch Tay Limestone" in *Transactions, Geological Society of Glasgow*, Vol. X., p. 302.

tree and on its large branches. In the village, near the railway station, three Gean trees grow, the largest measuring 9 ft. 8½ in. in girth at 5 ft. from the ground, with a bole of 9 ft. Several of the party, who had gone to Killin on the Saturday preceding, visited Ben Lawers, while others visited Glen Lochay. In Glen Lochay a cup-marked stone, and a cup-and-ring-marked rock near Duncroisg, were examined. At Boreland two fine trees were measured —(1) an Ash with a trunk 15 ft. 1 in. in girth at 5 ft., bole about 25 ft.; and (2) a Wych Elm measuring 13 ft. 5 in. in circumference at 5 ft. from the ground, bole about 20 ft. Lower down Glen Lochay a Birch was measured, the trunk of which had a girth of 7 ft. 6 in. at 5 ft. On the side of the main road, near Bridge of Lochay, is a grand Scotch Fir with a girth of trunk 12 ft. 2 in. at 5 ft. This is the largest example of this species which has yet been measured at excursions of the Society. A number of bullfinches (*Pyrrhula europæa*, Vieill.) were seen in a plantation on the south side of the Dochart. Proceeding through the village, the celebrated view of the "Falls" of Dochart at the bridge was duly admired, and the burial place of the Macnabs on Innis Buidhe (the yellow isle) was visited. Thence the way was taken to Kinnell, which was formerly the principal residence of the chiefs of the Clan Macnab. Kinnell is now noted for a remarkable Vine (a Black Hamburg), which was planted in 1832. According to Mr. J. Cant, gardener to the Marquis of Breadalbane, "it rises 6 ft. before it branches off; at 1 ft. from the ground the stem measures 25 in. in girth; at 6 ft. it measures 23 in. It occupies a house of 171 ft. by 25 ft. or about 475 superficial square yards of glazed surface. The average weight of each ripe bunch is from 1½ to 2 lbs." In 1896 it produced 3,537 bunches, of which 2,914 were removed in thinning, and 623 came to maturity.* Near the above vine house is a Stone Circle, consisting of six stones. Taking the train at Killin Station, the

* This remarkable vine appears to have become widely known in recent years. M. Ch. Joly, a Vice-President of the National Horticultural Society of France, who visited Kinnell to see it in 1888, says, after comparing it with other vines remarkable for their size, such as those at Hampton Court and Frogmore, "C'est donc la vigne la plus étendue qui existe dans la Grande Bretagne." (See *Rambles in Breadalbane*, by Malcolm Ferguson. Glasgow: MDCCCXCI.)

party was taken, by arrangement, to Glen Oglehead Crossing, which was formerly the station for Killin. Walking a short distance northwards, the limestone and hornblende schist are seen dipping to the south-east—that is, in a direction opposite to that on the other side of Glen Dochart—which shows that the valley occupied by this glen and Loch Tay has been hollowed out of an anticlinal arch. The company thereafter retraced their steps down Glen Ogle. After tea at the hotel, the train was taken at Lochearnhead Station.

Lochwinnoch, 24th April, 1897.—On the afternoon of this date a small party visited Calder Glen, Lochwinnoch. Among the plants noted were *Chrysosplenium alternifolium*, Linn., *Luzula pilosa*, Willd., and *Cystopteris fragilis*, Bernh. At one place the stones in the running water were densely covered with the wiry olive-green filaments of an alga, *Lemanea fluviatilis*, Ag., one of the most highly organised of its class. Some of the filaments were nine or ten inches long.

Dalmuir, 8th May, 1897.—Few turned out to the excursion arranged for the afternoon of this date to Loch Humphrey Burn and Loch and the Kilpatrick Hills. The small party proceeded by Duntocher to the Loch Humphrey Burn, and kept by the rocks on its side most of the way. The rocks having a western exposure are the best here for the botanist. At Greenside there is a sharp turn in the burn, and the rocks face to the north, the "slacks" rising to 1,100 feet. Loch Humphrey was visited, and the return journey was made by the Hill Road (from which magnificent views were obtained) to the Station at Kilpatrick. Among the plants noticed were the ferns, *Cystopteris fragilis*, Bernh., *Phegopteris Dryopteris*, Linn.; and the following mosses, *Andreæa petrophila*, Ehrh., *Leucobryum glaucum*, Schp., *Blindia acuta*, B. & S., *Encalypta vulgaris*, Hed., *Bryum alpinum*, Linn., *Polytrichum alpinum*, Linn.

Ross Hall, Crookston, 11th May, 1897.—A few members visited the gardens and conservatories at Ross Hall on the evening of this date.

LAKE OF MENTEITH, 20th May, 1897.—This excursion, arranged for the day appointed for the local celebration of the Queen's Birthday, did not take place.

NEILSTON, 29th May, 1897.—On the afternoon of this date a fairly representative party turned out to visit Neilston Pad and Harelaw Dam. From the former, owing to the atmosphere being comparatively clear, an excellent prospect was obtained. By the side of a little loch near the "Pad," *Hippuris vulgaris*, Linn., was found. Harelaw Dam has been long celebrated for the large colony of Black-headed Gulls which nests on an island there. The gullery maintains its position in point of numbers, if, indeed, it is not larger in recent years. Numbers of the gulls have nested on the loch side, but the keepers, who have orders to protect the birds on the island, lift the eggs on the shore, as they attract trespassers. Most of the members and friends who were present succeeded in reaching the island, and much interest was excited at the droves of young gulls and at the great variety in the markings and colours of the eggs in the nests. In some cases little preparation had been made for the reception of the eggs, but in others the nests were substantially built. Several Tufted Ducks (*Fuligula cristata*, Leach) were seen on the loch. Perhaps the most interesting feature to the ornithologists present was the presence of the Great Crested Grebe (*Podicipes cristatus*, Linn.) on the loch, and a nest of this species, with three eggs, rewarded the diligence of one searcher. Although becoming well known during the past decade as a Scottish breeding species, this (*e.g.*, East Renfrewshire) was the first locality in which its nest was found in Scotland.

WEST KILBRIDE, 12th June, 1897.—This was a joint-excursion with the Ayr Natural History Society. The attendance was poor. From West Kilbride the road to Portincross was followed, and from this point to Fairlie the party kept by the shore. On leaving West Kilbride, *Claytonia perfoliata*, Don, was the first notable plant met with. At the shore a number of plants was found to be in a backward condition. In the neighbourhood of Portincross were found *Ligusticum scoticum*, Linn., *Geranium lucidum*, Linn.,

Hippophae rhamnoides, Linn., and a few plants of *Senebiera Coronopus*, Poiret, and *Allium vineale*, Linn. Further on a few plants of *Eryngium maritimum*, Linn., were seen. This attractive plant is becoming scarce along our shores, owing to the depredations of summer visitors. Among other plants noted may be mentioned *Sedum Telephium*, Linn., *Valerianella olitoria*, Mœnch, *Lepidium Smithii*, Hook., *Alisma ranunculoides*, Linn., *Ranunculus bulbosus*, Linn., *Cotyledon Umbilicus*, Linn., and *Botrychium Lunaria*, Sw.

Queen's Park, 15th June, 1897.—This was an evening excursion, conducted by Mr. J. Whitton, Superintendent of Parks. Unfortunately the weather was unfavourable, but a dozen members turned up at the rendezvous. The most interesting shrubs and trees in Queen's Park have already been referred to in these *Transactions* (Vol. IV., N.S., pp. 366-8). At Camphill the cool greenhouse was gay with a profusion of flowers. Although the flowering season of the Orchids was nearly past, many fine species were still seen in bloom, notably *Oncidium macranthum*, Lindl., *Odontoglossum Pescatorei*, Linden, and many Masdevallias. Two specimens of the curious little pitcher-bearing plant, *Cephalotus follicularis*, Labill., attracted some attention.

Garelochhead, 26th June, 1897.—This excursion was favoured with fine weather, but there were only eight members present. The following plants, not mentioned in the report of the last excursion to this locality (Vol. IV., N.S., pp. 107-9) were found near the top of the glen, which is just to the north of Garelochhead Station, *Oxyria digyna*, Hill, *Alchemilla alpina*, Linn., and *Asplenium viride*, Huds.

Botanic Gardens, 27th July, 1897.—This evening excursion was a failure in point of numbers, not more than a dozen members turning out to see the Gardens and the collections of plants in the glass-houses at their best. The following were observed in flower in the Rock Garden :—*Tradescantia virginiana*, Linn., *Primula grandiflora*, Bust., *Astrantia carniolica*, Wulf.,

Polemonium grandiflorum, Benth., *Hutchinsia alpina*, R. Br., *Potentilla formosa*, D. Don, *Erigeron speciosa*, DC., var. *superbum* (a very handsome member of the Compositæ), *Campanula pusilla*, Haenke, *Œnothera splendens*, Hort., *Armeria alpina*, Willd., *Gypsophila glauca*, Stev., *Centranthus ruber*, DC., *Cimicifuga racemosa*, Nutt., *Achillea Millefolium*, Linn., var. *rubra*, *Spiræa palmata*, Thunb., var. *alba*, *Campanula persicifolia*, Linn., *Veronica macrantha*, Hook., *Mimulus cupreus*, Regel, &c. The Yellow and White Water Lilies and several hybrid Nymphæas were in full bloom in the pond. The following were noted in the Bog Garden :—*Epilobium hirsutum*, Linn., *Ranunculus Lingua*, Linn., *R. Flammula*, Linn., *Alisma Plantago*, Linn., *Sium latifolium*, Linn., *Iris lævigata*, Fisch., *Butomus umbellatus*, Linn., *Typha angustifolia*, Linn., *Juncus effusus*, Linn., *Eleocharis palustris*, R. Br., *Mimulus luteus*, Linn., all these plants being in flower. The party then proceeded to the "Kibble," where the annexes or show-houses were brilliant with groups of Tuberous Begonias, large specimens of the Golden Lily of Japan (*Lilium auratum*, Lindl.), *Hyacinthus candicans*, Baker, and a miscellaneous collection of flowering plants. Special interest was taken in the Coral Tree, *Erythrina Crista-galli*, Linn., a splendid leguminous plant with large leaves and beautiful scarlet flowers; *Datura suaveolens*, Humb. & Bonpl., one of the Solanaceæ with immense white flowers; the Garland Flower, *Hedychium gardnerianum*, Rosc.; the Passion-flowers, *Passiflora Munroii*, Mast., and *P. cærulea*, Linn., &c. The following plants were observed in flower in the Cool Orchid House :—*Odontoglossum vexillarium*, Reichb., *O. Pescatorei*, Linden, *O. Rossii*, Lindl., *majus*, *Sobralia macrantha*, Lindl., *Lycaste aromatica*, Lindl., *Oncidium hastatum*, Lindl., *O. flexuosum*, Sims, *Epidendrum vitellinum*, Lindl., *majus*, *E. fragrans*, Sw., *Dendrobium formosum*, Roxb., *giganteum*, *Cattleya Harrisonæ*, Paxt., *violacea*, *Cœlogyne speciosa*, Lindl. In the Cactus House that singular diœcious plant belonging to the Yam family, the Elephant's Foot, *Testudinaria Elephantipes*, Salisb., as well as several succulent Euphorbias, including *Euphorbia varians*, Haw., and *E. canariensis*, Linn., the latter the source of the drug Euphorbium, received a share of attention. One of the largest of the palmate-leaved palms, *Sabal umbraculiferum*, Mart., and one

of the largest of the pinnate-leaved kind, *Ptychosperma Cunninghamiana*, K. Wendl., were regarded with interest, the former being in fruit and the latter in flower. In the Stoves a great variety of plants were in flower, including the peculiar Pelican Plant, *Aristolochia gigas*, Lindl., *Costus speciosus*, Sm., a handsome plant belonging to the Zingiberaceæ, and several Aroids with brilliant spathes. *Ficus Cooperi*, Hort., and *F. edulis*, Bur., were observed in fruit. Amongst ferns, *Acrostichum crinitum*, Linn., and *A. spathulatum*, Bory, seemed to excite the interest of those present, as they are so unlike other more familiar members of the family in all particulars. After a short visit to the Moss House, the company dispersed, leaving the inspection of the Herbaceous Ground to a future occasion.

Largs, 14th August, 1897.—On the afternoon of this date, Halkshill, Largs, was visited. The weather was unfavourable, and the party numbered only six. Some time was spent in the garden at Halkshill, which is finely sheltered from the east and north winds, and has a good southern exposure. Along the walls the Ivy-leaved Toad-flax (*Linaria Cymbalaria*, Mill.) occurred in profusion, while numerous climbing plants were observed, notably *Jasminum revolutum*, Sims, a species with yellow flowers and elegant dark-green foliage; *J. officinale*, Linn., with white and sweet-scented flowers; *Wistaria chinensis*, DC., &c. The collections of herbaceous plants and ornamental shrubs are extensive. After passing the mansion-house, the party proceeded up the glen, but did not go far, owing to the wet condition of the ground. The following micro-fungi were observed in the garden and policies:—*Peronospora trifoliorum*, De Bary—on *Lotus corniculatus*, Linn.; *Puccinia pulverulenta*, Grev.—uredospores and teleutospores on *Epilobium alpinum*, Linn.; *P. Baryi* (B. & Br.), Winter.—uredospores on *Brachypodium sylvaticum*, R. & S.; *Phragmidium fragariastri* (DC.), Schröt.—uredospores on *Potentilla Fragariastrum*, Ehrh.; *Melampsora circææ* (Schum.), Winter.—uredospores on *Circæa Lutetiana*, Linn.; *Trochila craterium*, Fr.—on dead leaves of *Hedera Helix*, Linn.; *T. buxi*, Capron.—on dead leaves of *Buxus sempervirens*, Linn.; *T. laurocerasi* (Desm.), Fr.—on dead leaves of *Prunus Laurocerasus*, Linn.;

Stegia ilicis, Fr.—on dead leaves of *Ilex Aquifolium*, Linn.; *Leptosphæria rusci* (Wallr.), Sacc.—on dead phyllodes of *Ruscus aculeatus*, Linn.; *Phyllosticta garryæ*, Cooke & Harkness. — on living leaves of *Garrya elliptica*, Dougl.; *P. tenerii*, Sacc. & Speg.—on fading leaves of *Teucrium Scorodonia*, Linn.; *Ceuthospora phacidioides*, Grev.—on dead leaves of *Ilex Aquifolium*, Linn.; *Coniothyrium concentricum* (Desm.), Sacc.—on a dead leaf of Yucca; *Septoria stachydis*, Rob. & Desm.—on fading leaves of *Stachys sylvatica*, Linn.; *Glœosporium ribis* (Lib.), Mont. & Desm. —on fading leaves of *Ribes rubrum*, Linn.; *Thyrsidium hedericolum* (De Not.), Dur. & Mont.—on a dead twig of *Hedera Helix*, Linn.; *Oidium monilioides*, Link.—on living leaves of *Agropyron repens*, Beauv.; *Penicillium roseum*, Link.—on dead leaves of *Buxus sempervirens*, Linn.

Cartland Crags, Lanark, 28th August, 1897.—This was a joint-excursion with the Scottish Natural History Society, Edinburgh, both Societies being well represented. The attention of the members of our Society was chiefly directed to the botany of the woods, where the luxurious state of the grasses was a striking feature, notably *Bromus asper*, Murr., and *Deschampsia cæspitosa*, Beauv. The plants found during the afternoon which may deserve mention were *Calamintha Clinopodium*, Benth., *Cnicus heterophyllus*, Willd., *Equisetum maximum*, Lam., *Hypericum quadratum*, Stokes, *H. dubium*, Leers, *Melica nutans*, Linn., *Scirpus sylvaticus*, Linn., *Vicia sylvatica*, Linn., *Arctium minus*, Schk.

Proceedings of the Society.

SESSION 1896-97.

29th September, 1896.

Mr. Robert Kidston, F.R.S.E., F.G.S., Vice-President, in the chair.

Before proceeding with the formal business, the Chairman made feeling reference to the loss which the Society had sustained, since its last meeting, through the death of the President, Professor Thomas King.

Mr. D. A. Boyd read a memorial notice of the late President (see page 1), and Mr. David Andrew and others paid a tribute of respect to his memory. It was agreed that an expression of sympathy should be sent to Professor King's relatives.

Mr. Joseph Somerville intimated the death of Mr. Alexander Mitchell, who had joined the Society in 1894.

Mr. E. Arthur, 231 Langside Road; Mr. Andrew Gilchrist, Darvel; and Mr. John Rough, 104 Buccleuch Street, were elected as Ordinary Members.

The Hon. Librarian, Mr. James Mitchell, placed on the table two books on horticulture and cattle fodders, presented to the Society by the author, Mr. Martin J. Sutton, F.L.S. The thanks of the Society were accorded to Mr. Sutton for his gift.

Mr. Andrew Gilchrist, Darvel, sent for exhibition *Medicago sylvestris*, Fries, from the Heads of Ayr, where it was stated to have been abundant in August. The plant had been identified by Mr. Arthur Bennett, F.L.S.

Mr. A. Somerville, B.Sc., F.L.S., exhibited fresh specimens of *Sium erectum*, Huds., from Galston Parish, collected by Mr. A. Gilchrist, a new Ayrshire record; and *S. latifolium*, Linn., from the Botanic Gardens. Mr. Somerville also exhibited specimens of

Cladium jamaicense, Crantz, six feet in height. These large specimens of the most handsome of the British Cyperaceæ were from Loch Knock, Islay. This is a new record for the South Inner Hebrides. Mr. S. M. Macvicar sent examples of this plant from Ardnamurchan, Moidart, and the Island of Coll, for comparison.

Mr. Richard M'Kay exhibited *Rumex scutatus*, Linn., from Craigmillar Castle, and other plants from the same neighbourhood, kindly lent for the purpose by Mr. C. O. Sonntag.

Mr. Robert Brown, M.D., read a paper entitled "Botanical Work in the Higher Swiss Alps." The different floral planes were illustrated by a series of recently collected specimens. Among the plants exhibited were *Anemone narcissiflora*, Linn., *Primula integrifolia*, Linn., *Pyrola uniflora*, Linn.

27TH OCTOBER, 1896.

Mr. William Stewart, Vice-President, in the chair.

REPORT OF THE COUNCIL (1895-96).

Membership.—During the past year 24 Ordinary Members and 3 Corresponding Members were added to the roll; the present Membership being as follows:—

Honorary Members, - - - -			14
Corresponding Members, - - -			39
Ordinary Members (Life), - -	31		
(Annual Subscriptions), -	209		
		240	
Total, - - -			293

Associates.—Six new names have been added; there are now 26 on the roll.

Obituary.—The obituary record for the year contains the names of Dr. John Grieve (1856), Mr. Robert Blackie (1895), Mr. W. M. T. Yuille and Mr. William Dow (1885).

Meetings.—By a resolution adopted at the April Meeting, the Session was made continuous from September to August of each

year. Twelve Meetings were held during the Session, at which numerous interesting exhibits and important communications were laid before the Society.

At the beginning of the Session the Society was unfortunately deprived of the services of the Secretaries. Mr. R. D. Wilkie kindly acted for the Council until the month of May, when Mr S. M. Wellwood assumed the duties of Secretary.

The Constitution has been revised, and several important changes made therein. A new office has been created—Hon. Editor of Transactions. Entry-money for new Members has been abolished. The Subscription for Associates has been raised to Five Shillings, and the privilege of the Library extended to them.

Excursions.—A programme of Excursions was arranged jointly with the Andersonian Naturalists' Society. These consisted of 13 Saturday afternoon excursions and 2 on local holidays. In addition to these, the Society had 3 excursions on Tuesday evenings to places in the vicinity of the city. The excursion to Dalry and Kilwinning was arranged jointly with the Geological Society of Glasgow.

The excursions were largely taken advantage of by the members, and special thanks are due to the Convener and Members of the Summer Committee for admirable arrangements successfully carried out.

Library.—The Hon. Librarian (Mr. James Mitchell) reported that the Library continues in a state of efficiency, and the interest of the members is unabated. The additions during the year have been varied and valuable. Thirty volumes have been added by gift, and four by purchase. Through the good offices of a Life Member, the Catalogue, which was prepared at the end of last year, was printed free of cost to the Society. All the books in the Library are in good condition.

Transactions.—The Hon. Editor (Mr. A. Somerville, B.Sc., F.L.S.) reported that, in the month of April of this year, there was issued to members the Part of *Transactions* for the twelve months ended 30th April, 1895. The Part for the sixteen months ended 31st August last, it is hoped, will be in the hands of members by the middle of winter. This Part will end Vol. IV. of the New Series, and will contain an Index to the volume.

British Association.—The Society is again enrolled on the List of Corresponding Societies of the British Association. Professor F. O. Bower, D.Sc., was appointed delegate for the Annual Conference.

Finance.—The Hon. Treasurer (Mr. John Renwick) submitted his Annual Statement of Accounts, duly audited. This statement showed a balance in the Society's Ordinary Fund of £97 6s. 5½d., and in the Life Members' Fund of £141 15s. From the Ordinary Fund balance there falls to be deducted the cost of publishing *Transactions* till 31st August, 1896, and the cost of Seebohm's *British Birds' Eggs.* (See page 151.)

The Reports were all unanimously approved of and adopted.

Vacancies in the Council were then filled up by the election of the following gentlemen:—Mr. Robert Kidston, F.R.S.E., F.G.S., as President; Mr. Joseph Somerville as Vice-President; Messrs. S. M. Wellwood and R. D. Wilkie as Hon. Secretaries; Mr. John Renwick as Hon. Treasurer; Mr. James Mitchell as Hon. Librarian; Mr. Alex. Somerville, B.Sc., F.L.S., as Hon. Editor; Messrs. Robert Brown, M.D., John Fleming, Geo. Russell, and the Rev. G. A. Frank Knight, M.A., as Members of Council. The Council consists, besides the foregoing, of the following gentlemen whose term of office has not expired—Messrs. Peter Ewing, F.L.S., and William Stewart, Vice-Presidents, John Cairns, Jun., J. Bruce Hunter, Richard M'Kay, Johnston Shearer, Robert Dunlop, Robert M. Morton, John Paterson, and James Whitton.

Messrs. James Jack and William Leighton were appointed Auditors.

Messrs. William Adam, 31 Commerce Street; Frank H. Agnew, 43 Dixon Avenue; G. F. Scott Elliot, M.A. (Cambridge), B.Sc. (Edinburgh), F.L.S., F.R.G.S.; Charles Hogg, 9 Wilson Street, Paisley; Geo. W. Ord, 198 St. James's Road; and Hugh Boyd Watt, 101 St. Vincent Street, were elected as Ordinary Members.

Messrs. Anderson Fergusson and Thomas Wilson were elected as Associates.

The Hon. Librarian intimated that the relatives of the late President (Professor King) had presented to the Society his valuable collection of scientific books, numbering about 150 volumes. The thanks of the Society were heartily accorded for the valuable gift.

The Chairman intimated that, as a mark of respect to the memory of the late President, and in recognition of this handsome gift, the Council recommended that two carbon enlargements be obtained from a photograph of Professor King which was laid on the table—one to be placed in the Council Room, and the other to be presented to Mrs. Ritchie, Professor King's sister. This proposal was agreed to.

Reports on excursions to Craigallian (see page 119), Tyninghame (see page 119), and Hamilton (see page 120), were read.

On behalf of Mr. C. O. Sonntag, Mr. John Renwick exhibited a number of plants collected in the neighbourhood of Edinburgh. These plants were illustrative of species which are either not found in the West of Scotland or are rare there. Among them were *Dianthus deltoides*, Linn., *Lychnis Viscaria*, Linn, *Caucalis daucoides*, Linn., *C. nodosa*, Scop., *Antirrhinum Orontium*, Linn.

Dr. T. F. Gilmour sent for exhibition *Hymenophyllum tunbridgense*, Smith, which had been found by him last week in the Kildalton Woods, Islay. This is an interesting addition to the known flora of the South Inner Hebrides. Mr. A. Somerville, B.Sc., F.L.S., read a short paper dealing with the distribution of this plant in Scotland, and with the points which distinguish it from its congener, *H. unilaterale*, Bory.

Mr. James Whitton, Superintendent of Parks, sent for exhibition a number of interesting greenhouse flowers from the new Propagating Houses of Glasgow Corporation in Queen's Park.

The Chairman (Mr. Wm. Stewart) exhibited an example of the Lacquered Polyporus (*Polyporus lucidus*, Fries), which Dr. Stevenson, Glamis, had kindly sent to the Society. This specimen, which came from the Isle of Wight, had been sent to the Cryptogamic Society of Scotland's Conference at Fochabers in September. There is only one Scottish record for the species—at Bothwell, many years ago—but it has been found in several places in England. It is very changeable in the character of the pileus and stem, but few species of Polyporus are as handsome as it is. The lacquered appearance, Mr. Purton states (*Flora Londinensis*), is due to a thick, glutinous, reddish juice which exudes from every part of the pileus and stipes, and soon dries.

The Chairman also read a paper entitled "Notes on the Mycology of Kelvingrove Park." (See page 75.)

24th NOVEMBER, 1896.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

The Chairman referred to the great loss the Society had sustained through the death of Mr. David Robertson, LL.D., F.L.S., F.G.S., who had been an active member since 1852, and had, during that long period, contributed many valuable papers and important exhibits. The Hon. Secretary was instructed to convey an expression of sympathy to Dr. Robertson's family.

Mr. A. Somerville, B.Sc., F.L.S., the Society's delegate at the opening of the Gatty Marine Laboratory, St. Andrews, submitted his report, which was read by the Rev. G. A. Frank Knight, M.A.

Mr. C. O. Sonntag, Edinburgh, was elected as a Corresponding Member of the Society. Messrs. William Bowie, 188 Comely-park Street; W. A. Donnelly, Miltonhill, Milton of Colquhoun, Bowling; Chas. Kirk, 156 Sauchiehall Street; John R. Lee, 42 Dundas Street; James Murray, 3 Campsie View, Hamilton; John Robertson, Eastwood, Thornliebank; and John Sloane, 201 Dumbarton Road, were elected as Ordinary Members.

Mr. Geo. Russell, for Mr. J. B. Mirrlees, exhibited a number of Orchids, and among them *Angræcum sesquipedale*, Thow., which bears a spur from a foot to eighteen inches in length. This plant is referred to by Darwin in his work on the fertilisation of orchids. In connection with this exhibit Mr. G. F. Scott Elliot, M.A., B.Sc., F.L.S., F.R.G.S., communicated some notes. He stated that it was not uncommon near Fort Dauphin, in the South-east of Madagascar. He had been obliged to remain there on one occasion for three months, and during that time made some attempts to find its fertiliser. He caught many varieties of Sphinx Moth on it, some of them having proboscidea fully eighteen inches long, but he was never able to catch one on the flowers. These moths went eventually to Paris, and M. A. Grandidier declared them to be all new forms. *Angræcum superbum*, Thow., was also common at Fort Dauphin, and with this orchid Mr. Scott Elliot had been more fortunate, as he saw a beautiful little Sun-bird (*Cinnyris souimanga* (Gm.)) sipping its honey. The flowers of this Angræcum grow pretty densely along the peduncle, and it was very interesting to watch the neat and

workmanlike manner in which the Sun-bird visited them all. Mr. Scott Elliot is of opinion, however, that this plant is also visited by night-flying moths of the Sphinx order.

The Rev. G. A. Frank Knight, M.A., exhibited a number of nests of the Trap-door Spider (*Cteniza cæmentaria*, Latr.), which he had gathered at Hyères, in the South of France, during April, 1896. The most westerly of the health-resorts of the Riviera, Hyères is not situated on the sea-coast, but at a distance of three miles from the shore, while the large fortified city of Toulon is about five or six miles still further towards the west. At the back of the town there rises a curious precipitous hill, flanked with crags on two of its sides, and crowned with a ruined fortress. From this "coign of vantage" there is an extensive view of the wall of mountains towards the north, while southwards the eye sweeps over the undulating country dotted with the groups of palm trees for which Hyères is famous, till it rests upon the long line of the Mediterranean, the blue expanse of which is broken here and there by groups of small islands. This hillside is lined with many a path, and on the banks of these shady walks, amongst the reddish soil, the trap-door spider makes its home.

Mr. Knight described how wonderfully the spider manages to conceal its nest, making the lid of its hole to correspond most closely with the character of the surrounding soil. Indeed, once the door is closed, it is almost hopeless to attempt to look for the orifice in the ground. The specimens exhibited showed that the external coat of the nest is coarse and crumpled, more like the rough bark of a tree than a spider's web. But inside there is a layer of a very different character. It is smooth to the eye, and of a silken softness to the touch, and when examined by a microscope it is seen that the surface is composed of minute threads twisted together without the least apparent order. The subterranean galleries constructed by these spiders are sometimes of great length, and tortuous to such an extent that traces of them are soon lost. In connection with the formation of the lid—the characteristic feature of the homes of these spiders—Mr. Knight pointed out a fact which had come under his observation. While removing the superfluous earth and pebbles from the nest, after it had been dug out from the ground, he found that, in many cases, the spider had adopted a plan of making sure that the door would shut easily and

quickly. Not content with constructing the orifice to its gallery at a place where there is a natural slope of the ground, and where, therefore, when it leaves its home in search of food the trap-door will fall into its socket and keep the cellar closed till its return, the spider has actually employed a weight to make the lid shut more securely. On the under surface of the lid, in many instances, a small pebble is fixed, woven on by means of a silken web, and this serves to hold the door fast, even when gusts of wind are sweeping along the exposed ground. The spider itself has a most formidable pair of fangs, and from the fact that their bases are furnished with a series of sharply pointed barbs, the creature derives its name of *Cteniza*, from the Greek word (κτεις) signifying "a comb."

Mr. Anderson Fergusson exhibited some rare Ayrshire Coleoptera, including (1) *Geotrupes typhœus*, Linn., which was first recorded in Scotland by Don, in Headrick's *Agriculture of Forfarshire* (1813). It was again recorded for the same county in Wilson and Duncan's *Entomologia Edinensis* (1834), and in recent years has been recorded in the *Annals of Scottish Natural History* by Messrs. Lennon and Douglas for Kirkcudbrightshire, and Mr. William Evans for Arran. The specimens exhibited, two males and a female, were found by Mr. Thomas Wilson, in April, 1895, on Irvine Moor; and another male was found in the same locality in May by Mr. Wilson. (2) *Lampyris noctiluca*, Linn., the Glow-worm, from Barr, of which one male and two females were shown. It has also been recorded from Girvan, but appears to be very uncommon in Ayrshire. (3) *Heliopathes gibbus*, F., two specimens from Irvine Moor, found in April, 1896, and one found in 1895 at Prestwick. The Irvine specimens were all found under little heaps of sand about the size of a worm-cast. If the heap was disturbed, the beetle was found lying just beneath the surface of the sand. (4) *Exomias araneiformis*, Schrank.—Several examples of this species were taken in a moss in a locality near Ayr in 1893; and in June, 1896, Mr. Fergusson found one near Barr. Mr. Morris Young has also taken it in the Paisley district. This is an addition to the Scottish list. It is not, however, strictly speaking, a new Scottish species, as, although not included in Dr. Sharp's list, Murray had included it in his "Catalogue" as occasional. (5) *Acanthocinus ædilis*, Linn., which was found on the wall of a

house in Sandgate Street, Ayr. It had probably been introduced in wood.

On behalf of the Earl of Haddington, F.S.A. Scot., Corresponding Member, Mr. John Paterson exhibited a Roller (*Coracias garrulus*, Linn.), which was shot at Tyninghame on the day the Society visited that estate, 28th September of this year. His lordship also communicated the fact that in the autumn of 1875 or 1876 another example of this species had been observed on at least three occasions, in a plantation on Sir David Baird's property, and subsequently in Binning Wood. There was also exhibited, on behalf of his lordship, two Albino Hedgehogs (*Erinaceus europæus*, Linn.), adult and young respectively, which had been procured from Somersetshire.

Mr. Paterson also exhibited a Baillon's Crake (*Porzana bailloni*, Vieill.), through the courtesy of the officials of the Chadwick Museum, Bolton, whose property it is. This, which was believed to be the fourth Scottish example of this species, was found in Lochwinnoch Parish, Renfrewshire, in the middle of May, 1893. It had been killed through coming in contact with telegraph wires.

Mr. Henry M'Culloch showed a Grey Phalarope (*Phalaropus fulicarius*, Linn.), procured recently near Craigend Castle, Milngavie.

A small collection of the eggs of Arctic birds from Franz Josef Land was exhibited by favour of Captain Crowther, ice-master of the s.s. "Windward."

Mr. John Renwick, by favour of Mr. A. Campbell Finlay, exhibited the head of a Walrus from Franz Josef Land.

On behalf of Mr. Christopher Sherry, there was exhibited a branch of *Eucalyptus pauciflora*, Sieber, taken from a plant growing in the grounds of Craigandarroch, Blairmore. This plant had been sent from the Botanic Gardens, Glasgow, ten years ago, when it was only seven inches high. It now measures 16 feet, and it is 7½ inches in circumference at 3 feet from the ground. It has stood the last ten winters without the slightest protection, and the severe frosts of 1892 and 1894, when the thermometer fell to zero, failed to injure it in any way. During the summer of 1896 it flowered freely, and on the branch exhibited several panicles of fruits were to be seen. *E. pauciflora* appears to be

the hardiest member of its genus, and it is much better adapted for outdoor cultivation than the Blue Gum Tree (*Eucalyptus globulus*, Labill.).

29TH DECEMBER, 1896.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

A portrait of the late President, Professor Thomas King, to be placed in the Council Room, was exhibited, and a letter was read from Mrs. Ritchie, Professor King's sister, acknowledging receipt of a duplicate copy of the portrait which the Society had presented to her.

The following were elected as Ordinary Members of the Society:—Messrs. John Alexander, 18 St. Enoch Square; George Herriot, 29 Lacrosse Terrace, Hillhead; James Horn, 591 Great Eastern Road; Miss Sophia B. Robbie, 9 Argyle Terrace, Kirn.

Mr. James M'Andrew, Corresponding Member, sent for exhibition *Œdipodium Griffithii*, Schwæg, from Bennan Hill, New Galloway, and *Hedwigia ciliata*, Ehrh., var. *striata*, Wils., from Greenan Holm, New Galloway.

Mr. R. D. Wilkie exhibited *Amblystegium Sprucei*, B. & S., from the Falls of Clyde. Mr. Wilkie also exhibited a handsome species of Lousewort (*Pedicularis Sceptrum-Carolinum*, Linn.), from Vadsö, Lapland, and some Norwegian Mosses, all from Mr. W. E. Nicholson, Lewes. Mr. Nicholson also sent for exhibition *Manomitrium tenerum*, Lindb., a rare British moss from Ashdown, Sussex. This minute moss was first recorded as a British species from Hurstpierpoint, Sussex, in 1854, and has not since been found in any other British locality until discovered by Mr. Nicholson in the same county in September this year. *Paludella squarrosa*, Brid., another of the mosses exhibited by Mr. Wilkie, is the only member of a distinct genus. Formerly found in Britain in two localities, viz., at Terrington Carr, Yorkshire, and Knutsford Moor, Cheshire, it has now disappeared from both, owing to changes in the ground through drainage, and its claim to rank as a British moss at the present day is very slender. It is common in Scandinavia and in North America.

Colonel J. S. Stirling and the Chairman exhibited a collection of Stirlingshire Sphagnaceæ, as follows, viz.:—*Sphagnum Austini*,

Sull., *S. Austini*, Sull., var. *imbricatum*, Ldb., *S. papillosum*, Ldb., *S. papillosum*, Ldb., var. *confertum*, Ldb., *S. cymbifolium*, Ehrh., and the varieties *congestum*, Schp., and *squarrosulum*, N. Hsch. St., of this species; *S. subsecundum*, Nees, *S. rigidum*, Schp., var. *compactum*, Schp., *S. squarrosum*, Pers., *S. squarrosum*, Pers., var. *teres* (Ångstr.), Schp., *S. fimbriatum*, Wilson, *S. strictum*, Ldb., *S. acutifolium*, Ehrh., and the following varieties of this species: *deflexum*, Schp., *purpureum*, Schp., *rubellum*, Russ., *elegans*, Braithw., *læte-virens*, Braithw.; *S. intermedium*, Hoffm., *S. cuspidatum*, Ehrh., and var. *plumosum*, N. & H., of this species.

Mr. Robert S. Houston, on behalf of the Paisley Naturalists' Society, exhibited a number of rare Renfrewshire plants, including *Centaurea Scabiosa*, Linn., from a railway bank near Arkleston; *Drosera intermedia*, Hayne, which is plentiful at Linwood Moss; *Lepidium campestre*, R. Br., from near Bridge of Weir; *Linaria Pelisseriana*, Mill., from a railway bank near Cardonald; *Æthusa Cynapium*, Linn., from the Greenock Road; *Anagallis arvensis*, Linn., from Ferguslie; *Echium vulgare*, Linn., from Elderslie, and it has been found in half-a-dozen localities west of Paisley this year; *Empetrum nigrum*, Linn., from the hills above Greenock, where it is plentiful; *Euphorbia Peplus*, Linn., from near Bishopton; *Galium boreale*, Linn., from Bridge of Weir; *Gentiana campestris*, Linn., from Corkindale Law; *Myrica Gale*, Linn., which is plentiful at Kilmalcolm; *Origanum vulgare*, Linn., from Bishopton Station, where it has been established for several years; *Papaver Argemone*, Linn., from near Elderslie; *Parietaria officinalis*, Linn., on Stanley Castle; *Prunus Avium*, Linn., from Calder Glen, Lochwinnoch; *Rhynchospora alba*, Vahl., which is plentiful at Linwood Moss; *Vaccinium Oxycoccos*, Linn., which is abundant on the hills above Gourock; and *Verbascum Thapsus*, which occurs at Houston Station.

Mr. George Russell, on behalf of Mr. J. B. Mirrlees, exhibited two pots of ferns, *Trichomanes radicans*, Linn., and *Rhidopteris peltata*, Schott.

It was intimated that the Earl of Haddington, F.S.A. Scot., Corresponding Member, had presented to the Library *An Old Kirk Chronicle*, by P. Hately Waddell, B.D.

The following papers were read:—"The Constancy of the Bee,"

by Mr. George W. Ord (see page 85); "Preliminary Note on the Shapes of Leaves," by Mr. G. F. Scott Elliot, M.A., B.Sc., F.L.S., F.R.G.S. (see page 80); "On *Bipalium kewense*, Moseley," by Mr. Charles Hogg (see page 53); and "On some Coll and Tiree Plants," by Mr. Symers M. Macvicar (see page 55).

27TH JANUARY, 1897.

Mr. Peter Ewing, F.L.S., Vice-President, in the chair.

Messrs. George Allan Cadell, C.A., 116 St. Vincent Street; Alexander Frew, M.B., C.M., Glendevon, Helensburgh; and Miss Ina Wilson, 5 Middleton Terrace, Paisley Road were elected as Ordinary Members.

Mr. James Chumley, Assistant to Dr. John Murray, F.R.S., &c., exhibited the following objects from the "Challenger" Expedition: —(1) Manganese nodules, sharks' teeth, and ear-bones of whales from very great depths in the ocean, and some typical examples of various deep-sea deposits; (2) Microscopic preparations, including plankton organisms, zeolitic crystals, cosmic dust, sections of rocks, minerals, and organic remains from great depths. These exhibits were displayed on tables in the Society's usual meeting room, and the members of The Microscopical Society of Glasgow placed at the disposal of this Society about forty microscopes for use on the occasion.

Thereafter the meeting was adjourned to the large hall of the Philosophical Institution, where Dr. John Murray, Ph.D., F.R.S., F.R.S.E., F.L.S., F.G.S., F.S.A. Scot., Director of the "Challenger" Expedition Commission, and Honorary Member of this Society, delivered a lecture on "The Greater Depths of the Ocean" to an audience which completely filled the place of meeting. The lecture was illustrated by maps showing the depths, temperatures, &c., of the oceans of the globe, and by many lantern slides representative of surface organisms, fishes, and the curious forms found at great depths; it was followed with intense interest throughout. At the close of the lecture the thanks of the Society were accorded very heartily, on the motion of Mr. Alexander Somerville, B.Sc., F.L.S., seconded by Mr. Peter Ewing, F.L.S., Vice-President.

23rd February, 1897.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

Mr. Paul Rottenburg, Holmhurst, Dowanhill Gardens, was elected as a Life Member. Messrs. C. F. Macdonald, 143 Watt Street, and William Foulds Martin, L.D.S., Braemar, Langside, were elected as Ordinary Members. Messrs. Ranald W. Macdonald, 70 Cambridge Drive, Kelvinside; John Stewart Rogerson, 48 Windsor Terrace; and John Tennant, 8 Hampden Place, Mount Florida, were elected as Associates.

Mr. William Stewart, Vice-President, exhibited the following species of Fungi, collected by Mr. D. A. Boyd, and sent by him for exhibition, from Halkshill Glen, Largs:—*Odontia fimbriata*, Pers., *Peziza coccinea*, Jacq., and *Corticium cœruleum*, Fr.

Colonel W. H. M. Duthie read a paper entitled "The Wild Birds' Protection Act of 1894, and the Future of British Oology" (see page 43). There was also exhibited, by lantern, a large series of views of birds' nests and eggs and nesting sites, from photographs taken from nature by Messrs. W. C. Monro and G. Burn Murdoch. The pictures were greatly admired for their beauty and variety, and appreciative remarks by Mr. William Stewart, Vice-President, Colonel Harington-Stuart, and Mr. David Andrew, followed.

A paper by Mr. James Whitton, Superintendent of Parks, Glasgow, entitled "Meteorological Notes and Remarks upon the Weather during the year 1895, with its general effects upon Vegetation," was held as read.

The Hon. Secretaries intimated the deaths of Mr. Henry Boswell, Oxford, Corresponding Member, and Messrs. Adam Knox and Norman D. Napier, Ordinary Members.

30th March, 1897.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

Mr. D. A. Boyd read a memorial notice of the late Mr. David Robertson, LL.D., F.L.S., F.G.S. (See page 18.)

Mr. John Renwick referred to the loss the Society had sustained through the death of Mr. C. O. Sonntag, Edinburgh, Correspond-

ing Member. The Hon. Secretary was instructed to convey an expression of the Society's sympathy to his widow.

The following were elected as Ordinary Members of the Society :—Messrs. Robert Brown, 54 Robertson Street; James Forsyth, 21 Castle Street; George Girdwood, Blythswood Terrace, Helensburgh; David Lindsay, 5 Leslie Street, Pollokshields; M. H. Macdonald, 3 Leven Street, Pollokshields; Alexander Napier, M.D., F.F.P.S.G., 15 Queen Mary Avenue, Crosshill; James J. Peck, 9 Broomhill Gardens, Partick; Andrew Riddell, 172 Saracen Street; David Robertson, Glendale, Uddingston; William Roberton, 273 Kenmure Street, Pollokshields; and Mrs. Margaret B. Peck, 9 Broomhill Gardens, Partick.

Mr. Richard M'Kay reported on an excursion to Campsie Glen on 27th March. (See page 121.)

Mr. John Smith, Corresponding Member, exhibited *Hypericum elodes*, Linn., and *Inula dysenterica*, Linn., from Ayrshire. Mr. Smith had found the former plant beside the Clachrie Burn, in Barr Parish, and on the Polgown Burn, in Colmonell Parish. It had been recorded previously from Dalrymple and Coylton Parishes. The latter plant was found in Ballantrae Parish; and Mr. Smith knows of no previous record for the county.

Mr. R. D. Wilkie exhibited *Heterocladium heteropterum*, Bruch. (var. ?), from the Falls of Clyde. This plant was exhibited at the meeting of the Society on 26th December last year as *Amblystegium Sprucei*, B. & S. The record was confirmed by Dr. Braithwaite, and in the part of his *British Moss Flora* which was last issued this is mentioned as the only Scottish record. A further examination of the plant by Mr. Wilkie showed it to be a variety of *Heterocladium heteropterum*, Bruch. This determination has been concurred in by Dr. Braithwaite, who sent specimens of *Amblystegium Sprucei*, B. & S., from North America, which were also exhibited at the meeting.

A collection of plants (the third series exhibited) made by the late Baron Fred. von Mueller, K.C.M.G., M.D., Ph.D., F.R.S., Government Botanist, Victoria, was shown by Professor Geo. Bell Todd, M.B., C.M.

Mr. D. A. Boyd exhibited an uncommon moss, *Leptobryum pyriforme*, Wils., which had been found in a garden-frame at West Kilbride.

Mr. John Paterson, Hon. Editor of Transactions, intimated, on behalf of the Publishing Committee, that the part completing Volume IV., New Series, of the Society's *Transactions*, was now in the hands of the Hon. Librarian for distribution. Mr. Paterson stated that thanks were specially due to Mr. Richard M'Kay for his labours in preparing indices to the volume.

A paper entitled "A List of the Algæ of Lamlash Bay," by the late Mr. David Robertson, LL.D., F.L.S., F.G.S., was read (see page 62). This paper was in course of preparation by Dr. Robertson immediately before his last illness, and was completed by Mrs. Robertson after his death.

A paper by Mr. R. S. Wishart, M.A., entitled "Garden Slugs at Work," was read. Slugs are well-known pests to gardeners, and recourse has been had to various means to extirpate them, or keep them within reasonable bounds. Though working mainly after sundown, in dull weather they may also be found "on duty" in the day-time. They seem to be pretty constant in their affection for one plant at a time, and, if their tracks are to be taken as evidence, they seem to go by the same route morning and evening. Among plants most readily attacked by these pests, French Marigolds, Asters, and Cauliflower may be mentioned, but in Mr. Wishart's experience the large-flowered *Chrysanthemum inodorum plenissimum* was to them the greatest favourite of all. The slugs seem to scent this plant from a considerable distance, and to make for it as long as a green leaf is left. Experiments to make them alter their course had only, for result, a little temporary confusion of their movements, which, however, was soon overcome. From all that could be seen of their ways and doings, it seemed evident that slugs do not just crawl out of the earth and move along at random till chance throws something in their way, but that their movements were guided by a fixed purpose, arising from a certain amount of intelligence. Sometimes their experience of one night determined their course for the next. When there was no pre-arranged plan, they used their senses to ascertain where the best food was to be found, and their faculties were so discriminating that they made a choice even at a distance which, relatively to their size and their rate of locomotion, was very considerable.

27th April, 1897.

Mr. Peter Ewing, F.L.S., Vice-President, in the chair.

Mr. John Renwick read a report on an excursion to Killin (see page 121), and Mr. S. M. Wellwood reported on an excursion to Calder Glen, Lochwinnoch (see page 123).

The following gentlemen were elected as Ordinary Members of the Society:—Messrs. Andrew Cunningham, 98 Mitchell Street; Ralston Mitchell, 33 Renfield Street; Robert Sheriff, 75 Buchanan Street; George H. Thomson, 27 Union Street; and Thomas Wyllie, 98 Mitchell Street.

Mr. John Smith, Corresponding Member, exhibited *Cochlearica danica*, Linn., from Troon.

Mr. J. Whitton exhibited *Corticium cæruleum*, Fr., found growing on an elm in Bellahouston Park.

Mr. Geo. Russell exhibited *Cypripedium caudatum*, Lindl., and *Masdevallia Veitchiana*, Reichb., var. *grandiflora*.

Professor F. O. Bower, M.A., D.Sc., F.R.S., F.R.S.E., F.L.S., addressed the Society on "Fixity of Position as a Factor in Plant-life." The address dealt with the disabilities of distribution, of inter-crossing, and of protection against animals or climate, implied by the fixity of position in plants, and numerous examples, illustrated by lantern, were given of the methods adopted by plants to overcome these difficulties. Members of kindred societies were invited to this meeting, and there was a large attendance.

25th May, 1897.

Mr. Wm. Stewart, Vice-President, in the chair.

Mr. Laurence Watt read a report on an excursion to Loch Humphrey Burn, &c. (see page 123).

In Mr. Chas. Hogg's absence the Chairman reported on an excursion to Ross Hall (see page 123).

The Hon. Secretary read a letter from Col. Stirling regarding an excursion arranged for the Queen's Birthday holiday to the Lake of Menteith, of which he had been appointed conductor. The excursion had proved abortive, and, on the motion of the Chairman, the Hon. Secretaries were instructed to convey to Col.

Stirling an expression of sincere regret on the part of the Society at the result.

Mr. John Paterson, L.R.C.P. & S. (Edin.), exhibited a collection of mosses (chiefly Norwegian), comprising all the European Andreæaceæ.

Mr. Christopher Sherry showed a section of a Beech tree, about 140 years old, cut down recently at the Botanic Gardens, and showing the initials "C.F." and a date (probably "May, 1816") near the heart-wood. It seemed probable that the inscription belonged to the second decade of the present century, as eighty rings of growth could be counted between the inscription and the bark. Mr. Sherry also exhibited an Anthurium of the Scherzerianum group, with double spathes, and particularly noticeable for its twisted spadix.

Mr. G. F. Scott Elliot, M.A., B.Sc., F.L.S., F.R.G.S., exhibited examples of the bark-cloth of Uganda, and described its preparation by the natives. In connection with it he showed on the screen a series of views which he had taken in Africa, and in his remarks he referred particularly to the Euphorbias of remarkable size and appearance, which characterise the Uganda region. Mr. Scott Elliot also exhibited samples of cotton, and made observations on their microscopic structure. He also exhibited a series of American plants collected by Mr. W. Moir.

Mr. Robert Dunlop exhibited caterpillars of *Chelonia caja*, Linn., *Arctia fuliginosa*, Linn., and a number of photographs taken chiefly at excursions of this Society.

Through the courtesy of Mr. E. H. Bostock, of the Scottish "Zoo," Mr. R. D. Wilkie exhibited eggs of the Indian Python (*Python molurus*, Gray). This animal is about 20 feet long, and about 24 inches in girth at the thickest part. The eggs, of which 29 were laid between a Friday and the following Wednesday, are rather larger than those of a goose.

Mr. Wilkie also exhibited the inflorescence of *Gunnera scabra*, a Chilian plant, the acid leaf-stalks of which are used as a substitute for rhubarb.

The following papers were read:—(1) "On the Grasping Power of Carboniferous Crinoid 'Fingers' or 'Branches,' and a Speculation as to whether the Bulk of the Carboniferous Crinoidea were Fixed or Floating Animals," by Mr. John Smith, Corre-

sponding Member (see page 58); (2) "Botanical Notes from Galloway for 1896," by Mr. Jas. M'Andrew, Corresponding Member (see page 72).

A reproduction of Sir Daniel Macnee's portrait of Sir W. J. Hooker, presented to the Society by Sir J. D. Hooker, an Honorary Member of this Society, was placed on the table, and the Hon. Secretaries were instructed to convey to the donor the thanks of the Society for the gift.

29TH JUNE, 1897.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

Reports of excursions to Neilston Pad (see page 124), West Kilbride (see page 124), Queen's Park (see page 125), and Garelochhead (see page 125) were read.

Mr. Charles Hogg exhibited the King Bird of Paradise (*Cicinnurus regius* (Linn.)) and two Corncrakes (*Crex pratensis*, Bechst.).

Lemanea fluviatilis, Agardh, a fresh-water alga from Bardrain Glen, Gleniffer, was exhibited by Mr. S. M. Wellwood. This species is not common in Britain, but it has been found several times in the West of Scotland. The specimens exhibited consisted of sexual shoots or "fronds." Mr. Wellwood gave the following brief general outline of the life-history of a Lemanea from the observations of Professor Atkinson, of the Alabama Polytechnic Institute, U.S.A.:—"On the germination of the carpospore a series of cells are formed, which may consist of short polyhedral cells or confervoid filaments. This is the first form of the protonema, and is described as the prostrate form. This form is permanent, and gives rise to the secondary form, which bears a striking resemblance to a Chantransia plant, but produces no gonidia. In Batrachospermum the secondary stage is also Chantransia-like, but bears gonidia, the non-sexual spores of which may propagate the form indefinitely without developing a sexual shoot of the Batrachospermum. In Lemanea the Chantransia form is sometimes developed directly from the spore. The last form of the Lemanea plant is the sexual shoot or 'frond.' These 'fronds' originate as special lateral shoots from the Chantransia form. The individual shoot is simple, or bearing short branches sparingly. It consists of a single row of tubular cells, and

displays well-marked whorls of three or four papillæ at regular intervals, which give it a nodulose appearance. The male elements are found in the region of the swellings. A transverse section shows a remarkably highly developed cellular system for a fresh-water alga. On the outside there is a cortical layer, the cells of which are richly charged with colouring matter. A layer of transparent cells follows, and in the hollow centre there is a series of delicate filaments bearing apparatus for fertilisation."

Mr. John Renwick exhibited, on behalf of Mr. Thomas Service, a fine series of sharks' fossil teeth, belonging to the genus Lamna, from a phosphate deposit in Algeria, about 100 miles inland and 1,000 feet above sea-level. They appear to belong to Miocene or Middle Tertiary Age. Similar teeth were brought up in the dredge by the "Challenger" expedition from the bed of the Atlantic at a depth of two miles. In the "Challenger" specimens the cusps were decayed away, but the teeth from Algeria are perfect. Mr. John Young, LL.D., made some interesting remarks regarding this exhibit.

Adoxa Moschatellina, Linn., and *Neottia Nidus-avis*, Rich., from Carrick Hill, Maybole Parish, and *Hyoscyamus niger*, Linn., from the Heads of Ayr, in the same parish, were sent for exhibition by Mr. Thomas Wilson, Ayr. None of these plants is recorded in Mr. John Smith's *Botany of Ayrshire* for this parish.

Mr. John Paterson read the following papers:—(1) "On the Distribution of the Chiff-Chaff (*Phylloscopus rufus* (Bechst.)) in the Clyde Area" (see page 48); (2) "Notes on the Summer Bird-life of Ailsa Craig."

A paper entitled "Meteorological Notes and Remarks upon the Weather during the Year 1896, with its General Effects upon Vegetation," by Mr. James Whitton, Superintendent of Parks, was held as read (see page 105).

3rd August, 1897.

Mr. Robert Dunlop in the chair.

The following gentlemen were elected as Ordinary Members of the Society:—Messrs. Michael Cuthbertson, F.R.H.S., Sunny Park Nurseries, Rothesay; and John Mackie, Crofthead, Neilston.

Mr. Charles Hogg exhibited examples of the Long-eared Owl (*Asio otus* (Linn.)), and the Tawny Owl (*Syrnium aluco* (Linn.)), the latter from Markinch, Fife.

Mr. Charles Kirk sent for exhibition a beautiful female specimen of the Great Northern Diver (*Colymbus glacialis*, Linn.), from St. Abb's Head.

Mr. R. D. Wilkie exhibited a Slow-worm (*Anguis fragilis*, Linn.), from the Greater Cumbrae.

Cynomyia alpina, Ztt., a dipteron discovered at Barr, South Ayrshire, in June, 1896, by Mr. Anderson Fergusson, was exhibited by that gentleman. There appears to have been but one British record for this species before its discovery by Mr. Fergusson. (See *Annals of Scottish Natural History*, January, 1897.)

A collection of herbaceous plants was exhibited by Mr. Michael Cuthbertson.

Mr. Johnston Shearer exhibited *Genista anglica*, Linn., and *Pyrola rotundifolia*, Linn., from Ballater, Aberdeenshire.

Mr. John Renwick exhibited *Carlina vulgaris*, Linn., *Tragopogon pratense*, Linn., *Allium vineale*, Linn., and *Campanula glomerata*, Linn., from St. Cyrus, Kincardineshire.

Mr. Christopher Sherry exhibited the Australian Glory Pea (*Clianthus Dampieri*, A. Cunn.), with truly gorgeous flowers, from the Botanic Gardens. At one time this plant was extensively grown in greenhouses, but it has now become somewhat neglected on account of the difficulty found in cultivating it.

Mr. Thomas Wilson exhibited *Lepidium Smithii*, Hook., from near Ayr, and *Tragopogon minor*, Fries, from Hawkhill, near Ayr.

Mr. William Stewart sent *Agaricus sordidus*, Fries, for exhibition from the Botanic Gardens.

A letter from Mr. Robert H. Read, M.B.O.U., was read, acknowledging election as a Corresponding Member. Mr. Read sent reprints of lectures and papers read by him before the Ealing Microscopical and Natural History Society between 1893 and 1896. As a matter of interest to Clyde ornithologists, Mr Read pointed out that in April, 1897, he had visited the heronry at the north end of Bute (referred to in his paper read 10th February, 1894, before the Ealing Society), and found that it had ceased to exist, some old nests alone remaining.

31st August, 1897.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

Reports on excursions to the Botanic Gardens (see page 125) and Cartland Crags (see page 128) were read.

Mr. William Stewart exhibited the skull of a Hare and the lower jaw of a Boar, lent by Mr. J. M. Campbell, F.Z.S., illustrating the law of growth in the teeth. The Hare, which was shot near Lincoln, had, as the result of an accident, developed incisors of an abnormal size, curving spirally outwards; while in the jaw of the Boar one of the canine teeth had curved backwards until it had forced its way into the jaw again, in an almost circular direction. The latter specimen came from the South Seas, where the natives, who value such teeth for bracelets, assist the growth by the withdrawal of the opposing upper tusk.

Mr. Peter Ewing, F.L.S., Vice-President, exhibited a number of plants from the Forfarshire and Perthshire (Breadalbane) Mountains. He stated that for the past twenty-nine years he had regularly visited Ben Lawers, and every year he finds the status of its characteristic plants altering, and evidence of change in the configuration of the mountain. A large patch of *Cystopteris montana*, Bernh., formerly inaccessible to most botanists, is now comparatively easily got at. A way has also recently been opened up to the place where Woodsia is abundant. *Saxifraga cernua*, Linn., and *Draba rupestris*, R. Br., were only to be seen this year as very small plants, but that might be owing to the backwardness of the season. *Gentiana nivalis*, Linn., is not so plentiful in many places as it used to be, and it is becoming quite rare on some of the rocks above Loch-na-cat. *Sagina nivalis*, Fr., is almost, if not altogether, a thing of the past. *Splachnum vasculosum*, Linn., has disappeared from three places where it was formerly abundant. *Alsine rubella*, Schrenk, seems to be disappearing, as the plants are very small compared with those formerly obtainable. *Phleum alpinum*, Linn., is never seen now in the western ravine, and on the rocks above Loch-na-cat it is extremely rare. *Juncus castaneus*, Sm., has disappeared from some of its stations; in one of these a single plant being found where hundreds could have been collected some years ago.

Mr. John R. Lee exhibited some plants from the Deeside Mountains.

Mr. William Stewart, Vice-President, exhibited about thirty species of fungi from Cadder Wilderness, including *Agaricus* (*Amanita*) *spissus*, Fr., a new record for the Cadder district. Mr. Stewart also showed, from the Kibble Palace in the Botanic Gardens, two species of fungi which have been appearing there in great quantities for some weeks. They were *Agaricus* (*Hebeloma*) *crustuliniformis*, Bull., and *Ag.* (*Tricholoma*) *sordidus*, Fr., apparently introduced with the tramway-stable manure. *Bolbitius bulbillosus*, Fr., which was recorded in these *Transactions*, Vol. IV., N.S., p. 355, last year from Largs, as an addition to the British flora, has been found this year in Kelvingrove Park, and a specimen from this locality was exhibited by Mr. Stewart.

Mr. Christopher Sherry exhibited some specimens of Californian Cacti from the Botanic Gardens.

Mr. Johnston Shearer exhibited *Sambucus Ebulus*, Linn., from Queen's Park.

Mr. Peter Ewing, F.L.S., referred to some Ayrshire plants sent by Mr. Thomas Wilson, including *Scabiosa arvensis*, Linn., from Belmont, near Ayr; and to some plants from Ben Vorlich, Argyllshire, sent by Mr. L. Watt.

Mr. R. Wishart, M.A., exhibited under the microscope, and described, various sections of leaves.

The President (Mr. Kidston) exhibited microscopical preparations of two fossil plants, *Cryptoxylon Forfarense*, Kidston, from the Lower Old Red Sandstone, Reswallie, Forfar, and *Prototaxites Logani*, Dawson, from Canada. Cryptoxylon is not only new to science, but represents a type hitherto unknown in the plant world.

1895.—Sept. 1.						
To Balance—Life Members' Fund, on loan,			£36	10	0	
Ordinary Fund, on loan,	£15	0	0			
Do., in Bank,	85	0	0			
	£100	0	0			
Less due to Treasurer,	8	16	3			
			91	3	9	
					£127	13	9
1896.—Sept. 1.						
To 1 Life Member's Subscription,					5	5	0
,, 205 Members' Annual Subscriptions @ 7s. 6d.,					76	17	6
,, 22 ,, Entry-monies @ 7s. 6d.,					8	5	0
,, 5 ,, Arrears,					1	17	6
,, 26 Associates' Subscriptions @ 2/6,					3	5	0
,, Interest,					7	4	8
,, *Proceedings* sold,					6	19	1½
,, Donations for Illustration Fund,					5	7	6
,, One-fourth of Legacy by Sir Michael Connal, £2 10s.; *less* Duty, 5s.,					2	5	0
,, Reprints,					0	5	6
,, Received from Mitchell Library— For *Proceedings*,			£3	14	7		
,, Carriage on Foreign *Proceedings*,			0	14	10		
,, Allowance for Binding on *Transactions* of British Societies, transferred,			1	15	0		
					6	4	5
					£251	9	11½

From Balance of £97 6s. 5½d. fall to be deducted cost of *Transactions* for 1895-96, and cost of book on British Birds' Eggs (£2 2s.).

1896.—Sept. 1.						
By Rent and Attendance,					£9	14	6
,, Postage, Stationery, &c.,					17	6	7½
,, Printing Circulars,					12	9	6
,, ,, *Proceedings*,					44	5	10
,, Carriage on *Proceedings*,					1	9	3
,, ,, on Foreign *Proceedings*,					0	14	10
,, Donation to Millport Marine Station,					5	5	0
,, Library—New Books,					6	0	0
Binding,					5	15	0
Insurance,					0	6	0
Postages, &c.,					0	11	11½
Catalogue,					8	10	0
,, Balance Life Members' Fund on loan @ 4°/₀,			*£41	15	0		
,, Balance Ordinary Fund on loan @ 4°/₀,	*£40	0	0				
,, Balance Ordinary Fund in National Security Savings Bank,	70	0	0				
	£110	0	0				
Less due to Treasurer,	12	13	6½				
			97	6	5½		
					139	1	5½
					£251	9	11½

* On Security of Guaranteed Railway Stock.

Life Members' Fund—						
Invested in 2½ per cent. Debentures of The Modern Permanent Building and Investment Society, Melbourne,					£100	0	0
On loan at 4 per cent.,					41	15	0
					£141	15	0

GLASGOW, 16*th October*, 1896.—We have audited the above Accounts, compared same with the relative Vouchers and Securities, and find them correct.

(Signed) JOSEPH SOMMERVILLE, GEO. RUSSELL, } *Auditors.*

Notes on the Micro-fauna of Ailsa Craig, Firth of Clyde.

By Thomas Scott, F.L.S., Corresponding Member.

[Read 30th November, 1897.]

There was published in 1895, by the Rev. Robert Lawson, of Maybole, a new and enlarged edition of a rather interesting brochure on the History and Natural History of Ailsa Craig. This "lonely isle of the sea" is fully described by Mr. Lawson, and as the description is written in a plain and easy style, and illustrated by a series of fairly accurate and characteristic wood-cuts, the wayfarer who happens to be stranded on the Craig, and who has a copy of this little book as companion and guide, will have his visit made both interesting and instructive. In that portion of the little work which deals with the natural history of Ailsa Craig, Mr. Lawson gives an account of its avi-fauna, and there is also an extensive list of plants, including both phænogams and cryptogams, that were collected on the island by the late Professor Balfour and a party of students in 1845; but there is very little information about any of the other natural history groups. Reference is made to the occurrence of the Slow-worm and a few other organisms, but that is all. It may be that the apparent barrenness of the rock has stood in the way of a very minute examination being made of it, or perhaps the interest in its bird-life may have usually monopolised the time of visitors with a taste for natural history pursuits; but, whatever be the reason, little appears to have been done in the investigation of its invertebrates. Like the Bass Rock, in the Firth of Forth, Ailsa Craig is, no doubt, pre-eminently the home of the sea birds, and truly, if during the breeding season one takes a cruise round the island, and views the great multitude of birds, watches their ceaseless activity, and listens to the strange sounds produced by the blending of their varied and incessant cries, the whole forms a combination indescribable, and as each moment brings into view some new and interesting scene, words fail to describe one's

feelings, and silence becomes the truest exponent of our admiration and of the thoughts that elbow each other through the mind.

During the past two years I have had an opportunity of being at least twice ashore on the Craig, and my object in visiting it was partly to have a look at close quarters at the source from whence come the famous curling-stones, and partly to ascertain what kinds of Entomostraca and other crustacean species were to be found on its shores, or in the springs or pools of water that I had heard of as occurring on the island, but no special effort was made on these occasions to examine generally either the fauna or the flora. Moreover, the only part of the rock that has been visited by us hitherto is the south end, from Stranny Point on the west to the Lighthouse on the east. The last time I was ashore this year was on the Queen's Birthday. A strong wind had been blowing all the previous night, and our little vessel, the s.s. "Garland," had been obliged to seek shelter under the lee of the Craig; but towards afternoon the wind abated considerably, and, as the sky was clear, the weather at the south end, where we were sheltered from the wind, was warm and pleasant. Taking advantage of such a favourable opportunity, and accompanied by the genial skipper of the "Garland," I paid a short visit to the island. On shore, insects of various kinds were taking advantage of the pleasant sunshine to fulfil their life work, and one of the more common among them was the beetle known as the Seven-spotted Lady-bird (*Coccinella septempunctata*, Linn.). *Silpha thoracica*, Linn., and a few other beetles were also observed, but were much scarcer than the lady-bird. The small white butterfly was flitting about among the rank vegetation, and under some of the stones that were turned over in searching for Slow-worms a few Centipedes and Millepedes were noticed. Land mollusks, which are probably not very common on Ailsa Craig, were also occasionally observed during our visit, and comprised such forms as *Helix nemoralis*, Linn., *Hyalinia alliaria*, Miller, *Pupa cylindracea*, Da Costa, and *Clausilia rugosa*, Draparnaud, but the weather conditions, though pleasant, were not very favourable for shell-hunting, and in my experience it is not unusual to find that a locality which at one time may appear to be unproductive will at another time, when more favourable conditions prevail, be thronged with living creatures.

I have already stated, however, that my chief purpose for going ashore was to ascertain if there were any land or fresh-water Crustacea on the island, and, if so, what kinds they were. On my previous visit, I had examined some pools of water at the foot of the southern cliffs, but had only found the worm-like larvæ of insects in myriads—no Entomostraca were observed; indeed, had an Entomostracan happened to get into any of these pools, it would, no doubt, among such a ravenous crowd, have met with a short shrift. None of these pools was examined on our last visit, as it was considered that an attempt should rather be made to reach the so-called Garry Loch, which is situated fully midway up towards the top of the Craig, and therefore, acting on the instructions of the lighthouse keepers, whom we found most obliging, we selected the pathway that leads in a slanting direction up to the "Castle," as being, so far, the safest and most easy towards our goal. On reaching the sort of plateau on which the castle stands, a well in the vicinity of the castle was examined, but no Entomostraca were observed in it; the water was clear and cool, and almost devoid of animal life—at least such as could be seen with a hand lens. After a look at the old castle—near which, by the way, was a luxuriant bed of Wild Hyacinths in full bloom, a few of the flowers being pure white—we proceeded to the Garry Loch; and if the climb up to the castle was stiff, the path (if it could be called so) from thence to the loch was more so. We proceeded by what appeared to be the most direct route, but, whether it may have been so or not, we soon found that it was a rough road to travel. On reaching our destination, however, we considered ourselves repaid for all the trouble we had experienced in getting to it. The "Loch" occupies a nook which is surrounded on all sides, except the north, or north-east, by grassy and mossy banks, and only required a few bushy trees to be a typical "fairy dell." A large portion of the hollow is now filled up (forming a carpet soft and restful for the weary foot), and the loch is consequently reduced, especially in summer, to very small dimensions. The Marsh Marigolds referred to by Mr. Lawson were, at the time of our visit, in considerable abundance, and their golden flowers, which in the genial sunshine had expanded to their fullest extent, made the scene, though limited, very gay. It would appear that the loch was originally comparatively deep, for

the moss, which to so large an extent now replaces the water, has, according to Mr. Lawson, been probed to the depth of seventeen feet without touching the rock. With a hand-net I made a careful investigation of all that was left of the loch; and sometime afterwards, when the gathering I had collected was examined, some fairly interesting results were obtained. It was found that Entomostraca were moderately common in the gathering, though only four species were represented; it was also found that the species obtained were equally divided between the Copepoda and the Cladocera, and, moreover, that the two Copepods represented two very different groups, viz., the Cyclopidæ and the Harpacticidæ. One of the Copepods was *Cyclops bisetosus*, Rehberg, a species that was added to the British fauna a few years ago by Mr. D. J. Scourfield, of Leytonstone, Essex, and has only recently been observed in Scotland. The other Copepod was *Moraria Anderson-Smithi*, T. and A. Scott, which was first noticed in Scotland in 1892, in a gathering of shallow-water Entomostraca from Loch Morar, Inverness-shire. Our success in the examination of that loch was due, partly at least, to the active interest taken in our work by Mr. Anderson Smith, Ledaig, who was then a member of the Fishery Board for Scotland. *Moraria Anderson-Smithi*, T. and A. Scott, has, since its discovery in Loch Morar, been observed in several other places, and appears to be more or less generally distributed throughout Scotland—it was quite frequent in the gathering from the Garry Loch. The two species of Cladocera obtained in Garry Loch were *Chydorus sphæricus*, Müller, a common and widely-distributed species, and *Alona rustica*, T. Scott, which appears to be rare. *Alona rustica* was described in 1894 from specimens obtained in a collection of Entomostraca sent to me from Shetland, and has been observed in one or two other places since, but is always very scarce. Specimens of water mites, water beetles, and some other creatures were also noticed, and are included in the appended list, so far as they have been identified.

If the Garry Loch could have been examined towards the end of summer, it is quite possible that other Entomostracan species might have been obtained in it, as we find that different seasons frequently give different results; and also, if a thorough examination of the debris at the foot of the cliffs and of the more

accessible parts of the hill could be made at suitable seasons of the year, the list I now give might be considerably extended.

I may say, before concluding these "Notes," that I was not aware of Mr. Lawson's interesting *History* till just after our last visit to Ailsa Craig, and was under the belief that its natural history was better known than a perusal of Mr. Lawson's work appears to indicate, otherwise a more careful search of that part of the Craig visited by us would have been made, and greater attention given to the numerous creatures we saw during the time we were ashore

In the following list, which includes all the invertebrates observed by us, I am responsible for the names of the Mollusca and Crustacea; my friend Mr. Percy H. Grimshaw, F.E.S., of the Museum of Science and Art, Edinburgh, very kindly favoured me with the names of the Coleoptera and of the single species of Hymenoptera that was obtained; several other organisms that were met with have not yet been fully identified, and are referred to only by their family or generic names.

List of Invertebrata observed on Ailsa Craig, Firth of Clyde, as explained in the preceding "Notes":—

MOLLUSCA.

Helix nemoralis, Linn., with dark bands.
Helix nemoralis, Linn., yellow, and without bands.
Hyalinia alliaria (Miller) = *Zonites alliarius* of Jeffrey's "Conchology."
Pupa cylindracea, Da Costa, = *Pupa umbilicata*, of Jeffrey's "Conchology."
Clausilia rugosa, Draparnaud.

CRUSTACEA.

Isopoda.

Oniscus asellus, Linn.
Porcellio scaber, Latreille.

Copepoda.

Cyclops bisetosus, Rehberg.
Moraria Anderson-Smithi, T. and A. Scott.

Cladocera.

Alona rustica, T. Scott.
Chydorus sphæricus, Müller.

INSECTA.

* Coleoptera.

Silpha thoracica, Linn. *Melanophthalma fuscala*, Humm.
Coccinella septempunctata, Linn. *Agabus bipustulatus*, Linn.
Philhydrus melanocephalus, Olivi.

Hymenoptera.

Homalomyia canalicularis, Linn.

Lepidoptera.

Small white butterfly (*? Pieris rapæ*).

Hemiptera.

A species of "Boat-fly" (*Corixa* sp.).

Thysanura.

(?) *Podura* sp.

Arachnida.

A few "water mites."

Myriapoda.

Lithobius sp. *Iulus* sp.

Additional notes.—(1) In Pennant's "Tour in Scotland," fourth edition, vol. ii., p. 190, that author, in referring to his visit to Ailsa Craig, says, *inter alia*—"Three reptiles appeared here very unexpectedly, the naked black snail, the common and the striped shell snail: not volunteer inhabitants, but probably brought in the salads of some visitants from the neighbouring shores."

(2) My friend, Mr. James Steel, informs me that he observed the Wood Tiger Moth (?) *Chelonia plantaginis*, Linn., on one of his visits to Ailsa Craig, which adds still another to our list of invertebrates.

(3) I find, on looking through some literature relating to the West of Scotland, that two other and former members of this Society have taken a considerable interest in Ailsa Craig and its natural history, viz., Mr. Robert Gray, who studied its bird life, and Mr. Newton MacCartney, who examined its geological structure, and also in 1864 (according to Dr. Bryce) made a careful investigation of its plants, but apparently no systematic study of its invertebrates has hitherto been taken in hand, yet the study of these might prove to be as interesting as the others.

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* At the meeting of the Society on 25th January, 1898, Mr. Anderson Fergusson exhibited the following additional species of Coleoptera from Ailsa Craig, viz., *Byrrhus pilula*, Linn., *Otiorhynchus blandus*, Gyll., and *O. rugifrons*, Gyll.

Micro-fungi observed near Kilmarnock, Ayrshire.

By D. A. Boyd.

[Read 28th September, 1897.]

Very little information has as yet been published regarding the mycology of the district around Kilmarnock, and the following list of micro-fungi is therefore submitted as a contribution to the meagre stores of information on the subject. The species referred to in the list were observed by myself on 4th August, in the course of a short walk along the Fenwick Road, and in the wooded glen above Dean Castle :—

Synchitrium taraxaci, De Bary & Woronin.—On *Taraxacum officinale.*

Cystopus candidus (Pers.) Lev.—On *Capsella Bursa-pastoris.*

Peronospora nivea, Unger.—On *Ægopodium Podagraria.*

P. parasitica (Pers.) Tul.—On *Capsella Bursa-pastoris.*

P. trifoliorum, De Bary.—On *Lotus pilosus.*

Uromyces alchemillæ (Pers.) Winter.—Uredospores and teleutospores on *Alchemilla vulgaris.*

Puccinia violæ (Schum.) Winter.—Uredospores on *Viola sylvatica.*

P. rubigo-vera (DC.) Winter.—Uredospores on *Holcus mollis, Arrhenatherum avenaceum,* &c.

P. Baryi (B. & Br.) Winter.—Uredospores on *Brachypodium sylvaticum.*

Phragmidium fragariastri (DC.) Schröt.—Uredospores and teleutospores on *Potentilla Fragariastrum.*

Ph. subcorticatum (Schrank) Winter.—Uredospores on *Rosa canina.*

Melampsora farinosa (Pers.) Schröt.—Uredospores on *Salix Caprea.*

Coleosporium sonchi (Pers.) Winter.—Uredospores on *Tussilago Farfara.*

Ustilago segetum (Bull.) Winter.—On *Avena sativa.*

Tilletia striæformis (West.) Winter.—On *Holcus mollis.*

Entyloma microsporum (Ung.) Schröt.—On *Ranunculus repens.*

Protomyces macrosporus, Unger.—On *Ægopodium Podagraria.*

P. pachydermus, Thüm.—On *Taraxacum officinale.*

Trochila craterium, Fr.—On dead leaves of *Hedera Helix;* Dean House.

T. laurocerasi (Desm.) Fr.—On dead leaves of *Prunus Lauro-cerasus;* Dean House.

Botryosphæria dothidea, Ces. & De Not.—On living stems of *Rosa canina.*

Diatrype stigma (Hoffm.) Fr.—On dead branches of *Cratægus Oxyacantha.*

Sphærotheca Castagnei, Lev.—Mycelium on leaves of *Alchemilla vulgaris.*

Erysiphe cichoracearum, DC.—Perithecia abundant on *Symphytum tuberosum.*

Cytospora laurocerasi, Fckl., var. ramulorum, Sacc.—On dead branches of *Prunus Lauro-cerasus;* Dean House.

Septoria podagrariæ, Lasch.—On *Ægopodium Podagraria.*

S. stachydis, Rob. & Desm.—On *Stachys sylvatica.*

Oidium monilioides, Link.—On *Agropyron repens.*

Ovularia bistortæ (Fckl.) Sacc.—On *Polygonum Bistorta.*

Didymaria Ungeri, Corda.—On *Ranunculus repens.*

Additional Notes on the Peronosporeæ and Ustilagineæ of North Ayrshire.

By D. A. Boyd.

Read 28th September, 1897.]

On 27th December, 1892, I submitted to the Society a list of the Ustilagineæ of North Ayrshire,* in which were enumerated 16 species, with particulars of the host-plants on which they had been observed by me, and the localities in which they had occurred. On 24th April, 1894, a similar list of Peronosporeæ, enumerating 21 species, was also communicated to the Society.†

Since the dates when these papers were read, several additional species have been detected within the district, while certain fungi have been gathered on host-plants other than those formerly indicated, and in localities not previously reported.

In the following supplementary list, the mark "‡" is prefixed to the names of species not recorded for Ayrshire in my former papers, while additions to the number of host-plants and localities are similarly indicated:—

Peronosporeæ.

Cystopus spinulosus, De Bary.—On ‡*Cnicus arvensis;* rare; West Kilbride.

‡**C. lepigoni,** De Bary.—On *Lepigonum;* rare; Horse Isle (Ardrossan), August, 1896; sea-shore at Chapelton (West Kilbride), June, 1897. Specimens from the latter station have been submitted to Miss A. Lorrain Smith, British Museum (Natural History), who has kindly confirmed my identification of them.

Peronospora densa, Rabh.—On ‡*Pedicularis palustris;* not common; Knockewart Hill (Ardrossan).

* *Trans. Nat. Hist. Soc. Glasg.*, iv., N.S., p. 24. † *Ibid.*, p. 28.

P. lactucæ, Regel.—On ‡ *Senecio elegans;* Seamill.

P. arenariæ, Berk.—On *Arenaria peploides;* ‡ Ardrossan.

P. parasitica, Pers.—On ‡ *Brassica oleracea;* frequent; Seamill. On ‡ *Capsella Bursa-pastoris* and ‡ *Nasturtium officinale;* frequent; West Kilbride.

P. ficariæ, Tul.—On ‡ *Ranunculus repens,* ‡ *R. acris,* and ‡ *R. bulbosus;* frequent; West Kilbride.

‡ **P. violæ,** De Bary.—On *Viola arvensis;* abundant in a cornfield near Hunterston (West Kilbride), August, 1897.

P. trifoliorum, De Bary.—On ‡ *Lotus corniculatus;* not common; Halkshill (Largs). On ‡ *L. pilosus* and ‡ *Trifolium repens;* frequent; West Kilbride.

P. urticæ, Lib.—On ‡ *Urtica dioica;* frequent; West Kilbride.

Ustilagineæ, &c.

Ustilago violacea (Pers.) Winter.—In anthers of ‡ *Stellaria graminea;* frequent on roadsides near West Kilbride. In anthers of ‡ *Lychnis diurna;* frequent; Ardneil Bank, Glenhead Braes, &c.

Protomyces pachydermus, Thüm.—‡ Dalry; ‡ Ardrossan.

Meteorological Notes, and Remarks upon the Weather during the Year 1897, with its General Effects upon Vegetation.

By James Whitton, Superintendent of Parks, Glasgow.

[Read 26th April, 1898.]

In order to preserve the continuity of the series of notes, the figures dealt with are from the records kept at Queen's Park.

January.—With a prevalence of S.W. winds, the weather, until the 6th, was mild and pleasant for the season. Thereafter the winds were chiefly from north and east, and the weather became much colder, with unpleasant changes. On the occasions when frost was registered, dense fogs were very frequent in the city. These conditions continued until the end of the month. On the evening of the 29th a snowstorm set in, and continued with severity on the 30th. The fall of snow within the twenty-four hours was in many places about 6 inches, but it was of a soft nature and rapidly melted.

With the winds so frequently from the north and east, the rainfall was low, only 1·22 inches being recorded, of which a certain amount would be melted snow. The greatest amount recorded on one day was 0·40 on the 4th. There were twenty-three dry days.

During the month the atmospheric pressure, as indicated by the barometer, was somewhat irregular, varying between 29·40 inches on the 6th and 30·14 inches on the 20th. Then there was a sharp fall to 29·20 on the 25th, when there was a fall of snow to the depth of 1 inch. For three days thereafter there was a steady rise to 29·85 on the 28th, followed by a rapid drop to 29·10 inches during the prevalence of the snowstorm on the 30th.

Frost, amounting to 143°, was registered on twenty mornings—the lowest reading being on the 18th, when 16° of frost were

recorded. The average maximum temperature for the month was 38°, while the minimum was 29°, against 43° and 34° respectively for the corresponding month of the preceding year.

Any plants which showed signs of growth, owing to the mild, open weather of the closing months of 1896, were checked by the cold, frosty weather of January; and the soft, watery growths of laurels and similar shrubs were severely blackened.

February.—With the winds chiefly from the N.E., the first eight days were cold and cheerless, owing to the absence of sunshine. A sharp S.W. gale, accompanied by heavy rain, occurred on the 9th, and the weather was changeable and cold, with frequent dense fogs, until the 16th, after which it was milder and showery. A severe gale, with heavy rain, occurred on the 25th, and the rivers were in high flood on the 26th—the Kelvin overflowing its banks in the Kelvingrove Park. The rainfall amounted to 2·85 inches, of which 1·55 fell on the 25th and 26th. There were fourteen dry days in the month. The readings of the barometer show that the pressure, which was 29·15 on the 1st, kept steadily, though erratically, above that point the whole month. The highest reading was 30·20 on the 16th, and the sharpest drop was from 30·00 on the 24th to 29·35 on the 25th, when the gale was experienced. Though no very severe frosts were registered, the average temperatures were somewhat lower than in the corresponding month of 1896, which were abnormally high—then they were 47° on the maximum and 36° on the minimum, against 44° and 35° respectively for this year. Frosts occurred only on ten mornings, to the amount of 33°—again an unusual occurrence for February. With the absence of severe frost, and the open weather of the latter half of the month, vegetation quickly advanced. Snowdrops and Crocuses were in full bloom by the middle of the month, and by the 24th Rhododendron Nobleanum was in full flower, and other early flowering plants equally forward.

March.—The opening days of the month were cold and cheerless, with frequent heavy showers of hail and sleet. Although several dry days were experienced, the weather generally was disagreeable, on account of the prevalence of easterly winds; and

towards the close a series of severe gales, notably on the 22nd and 24th, did not improve matters, as these were succeeded by frost and slight falls of snow. The erratic readings of the barometer indicated the changeable condition of the weather. The pressure varied from 28·20 inches on the 4th, with sharp changes to 29·85 inches, which was the highest point reached. This occurred on three occasions during the month. The rainfall was heavy, and the amount recorded was 4·05 inches, nearly the same as in the previous March, when the amount was 4·21 inches. There were only eleven dry days. In regard to the temperatures, these, like the rainfall, closely corresponded to what was recorded for the same month in 1896. The total amount of frost only reached 27°—the thermometer being at or below freezing point on seven occasions, while in March, 1896, the frost amounted to 31° over ten occasions—the average maximum temperature being 47° and the minimum 36°, against 46° and 34° respectively.

Despite the changeable and somewhat unpropitious weather, several species of plants came into bloom during the month—those noted being *Daphne Mezereum*, Linn., *Erica carnea*, Linn., and *Rhododendron præcox*, Davis, on the 4th; Grape Hyacinths (Muscari), Squills (Scilla), and Dog's-tooth Violet (Erythronium) on the 15th; and on the 24th Rhododendron Eugenie; while in sheltered places the Balsam Poplar was putting forth its leaves on the 10th and the Hawthorn bursting its buds on the 24th; but the progress which vegetation had made was rudely checked, and the young growths on Dogwoods, Elders, &c., injured by the frosts and N.E. winds experienced at the end of the month.

April.—The weather experienced during this month was not of a very pleasant description, on account of the prevalence of cold easterly winds. The frost, which had set in during the latter days of March, continued for nearly a fortnight. With a change in the wind to westwards, there were several stormy days between the 10th and 17th, with heavy showers of rain and hail. Thereafter, until near the end of the month, the winds were chiefly from the N.E., and dry, cold weather prevailed.

The rainfall was moderate, 2·01 inches only being recorded, the greatest amount for one day being 0·84 inch, when we had a thunderstorm. There were nineteen dry days.

The readings of the barometer show an irregular pressure, but within a moderate range. The lowest reading was 29·05 inches on the 1st, and the highest 30·10 on the 23rd.

The comparative absence of sharp frosts in April, which has been noted of late years, was less marked this year, as the thermometer was at or below freezing point eleven times, and a total of 41° of frost registered. In 1896 only 7° of frost were recorded over three mornings of this month. The prevalence of easterly winds, however, tended to keep the temperature low, and the averages—maximum, 50°; minimum, 35°—are under those of the previous year, when the maximum was 56° and the minimum 38°.

With the cold winds and low temperature a decided and severe check was given to vegetation. The early growth and bloom of many shrubs were blighted, and the grass was less green than it was in March; whilst trees which usually are well into leaf by the middle of April were only coming into leaf during the latter days of the month.

May.—During the first fortnight, with the winds chiefly westerly, the weather was very changeable, high winds and heavy showers being of frequent occurrence. The latter half of the month was characterised by keen north-east winds, and throughout the month the weather lacked the genial quality usually associated with May, and the general conditions were in marked contrast to those which prevailed in May, 1896, which was exceptionally mild and pleasant.

The rainfall amounted to 2·66 inches, and there were twenty dry days. The barometric readings ranged, with moderate variations, from 29·65 on the 1st up to 30·30 on the 16th, then steadily falling to 29·06 on the 29th, on the occasion of a heavy storm of wind and rain on the night of the 28th and morning of 29th.

The continuance of strong easterly winds and comparative absence of sunshine accounted for the low temperature, which is in remarkable contrast to that of May, 1896. Then the maximum thermometer in shade was three times above 70° and only six times below 60°, whereas this year it was only six times above 60°. The highest reading was 66° on the 17th. Though frost was only recorded on one occasion—3° on the 13th—the

temperature was below 40° twelve days, consequently the averages are low—the maximum being 57° and the minimum 40°, against 63° and 43° respectively in May, 1896.

The prolonged cold, hard weather had its natural effect on vegetation. The Oak came into leaf on the 19th and the Ash on the 24th, the former sixteen and the latter twelve days later than in 1896. Apples, Pears, Hawthorns, Lilacs, Rhododendrons, &c., were likewise about the same time later in blooming. The Cuckoo was heard in Camphill on the 26th.

June.—The weather throughout this month was changeable, with frequent heavy rains. The first three days were cold and wet, a very severe thunderstorm occurring on the 2nd and 3rd. For a week afterwards we had dry weather and occasional bright sunshine, with the winds easterly. After the 10th, when the wind moved to the west, for a fortnight the weather, though milder, was very unsettled, and much rain fell. Towards the end of the month it became drier and more pleasant. Twice during the month the rivers were in full flood owing to the heavy rainfall—first with the rains of the 2nd and 3rd, when the quantities registered were 0·87 and 0·74 inch respectively; then with the extraordinary rainfall of the 16th, when 1·60 inches were recorded. The total amount of rain which fell during the month was 5·67 inches—a quantity much above the average, and which proved to be the largest amount for any month during the year. There were fifteen dry days. Owing to the winds being so much from the east, the barometer readings show a less erratic course than had the winds been westerly, the pressure being fairly steady between 29·50 and 30·00 inches. The only drop was with the storm on the 16th, when the pressure sharply fell from 29·96 on the 15th to 29·20 on the 16th, after which it rose irregularly for a few days, then kept steadily about 29·80 until the end of the month.

For the season the temperature was low. The highest reading of the thermometer in shade was 73° on the 6th, and it was only five times above 70°. The highest reading for June of the two preceding years was 78°. The average maximum was 62° and the minimum 49°, against 65° and 49° respectively for June, 1896.

Vegetation, owing to the ungenial atmospheric conditions, did not make much progress during the month. The foliage of most

trees and shrubs developed badly, and many species, notably Chestnuts, Acers, and such like, had a checked, stunted appearance, very unlike what obtained in the previous year, when the foliage of all trees was remarkably fine. The bloom on Pears and Apples, which was in many places fairly abundant, did not last for any time, and the display of flower on most trees and shrubs was not of a very brilliant or satisfactory nature. Grass, however, grew well, especially towards the end of the month, and the hay crops looked very promising.

July.—The early days of the month were fine and pleasant. Strong westerly winds, with heavy showers, were experienced from the 3rd to the 8th. For a fortnight thereafter the weather was bright and warm. Severe thunderstorms were experienced in the city on the night of the 23rd and in the afternoon and evening of the 24th. Otherwise, though several days were showery, the weather until the end of the month was mild and balmy.

There were twenty-one dry days in the month, and the rainfall was only 2·22 inches—much lower than what was recorded in the same month of the two preceding years, when the rainfall was above the average. The barometer chart does not show any noteworthy change, the range of pressure varying from 29·30 inches on the 6th to 30·15 inches on the 11th and 12th.

The thermometer in shade was over 70° on twelve days. The highest reading was 78° on the 16th, the average maximum being 67° and the minimum 50°, the former being 3° and the latter 1° higher than in July, 1896.

With the genial, warm weather there was a marked improvement on vegetation, the growth made by cereal and other crops being steady and satisfactory, while the dry weather in the middle of the month enabled the hay crop to be secured generally in excellent order.

August.—There was a continuance of the warmth which characterised July during this month, but as there was much more rain, the conditions generally were not so pleasant. For the first four days the weather was hot and sultry. A very severe thunderstorm occurred on the evening of the 4th, after which the weather, though warm, was uncertain and showery all the month, in

which there were only thirteen days without rain. On several occasions the rainfall was heavy; on the 11th no less than 1½ inches fell—the total amount registered for the month being 5·51 inches, much above what fell in August, 1896, though ½ inch less than in the same month of 1895.

The atmospheric pressure was somewhat low. Only on one occasion was it above 30 inches; this occurring on the 3rd, when it was at 30·10. There was a quick fall to 29·50 on the 6th, and the pressure then ranged between 29·70 and 29·10 all month. The winds varied a good deal in direction and force.

Despite the heavy rainfall, the temperature was high, and as the maximum thermometer in shade was ten times above 70° and only once below 60°, the averages are higher by 4° in each case than in August, 1896, the figures being—maximum, 67°; minimum, 52°.

The moist, warm weather tended to keep vegetation fresh and bright. Such trees as the Lime and Sycamore, which usually begin to lose their foliage in our city parks by the third week of August, were quite fresh at the end of the month. Grain crops filled up well, but were not ready for harvesting during the month.

September.—The weather was showery and somewhat colder until the 6th, then it kept dry and fine until the 20th, excepting on the 16th, when we had a heavy fall of rain. Showery, and at times disagreeable weather prevailed more or less until the end of the month. There were sixteen dry days, and the rainfall amounted to 3·39 inches.

The readings of the barometer show a wide range in the pressure. From 29·30 on the 2nd, it rose to 30·33 on the 14th, then it fell rapidly to 29·30 on the 18th, afterwards varying irregularly to 29·10 on the 26th and up to 29·90 on the 27th.

Though no frost was registered, the freezing point was closely approached on several occasions, and the temperature kept a somewhat low range, consequently the averages—maximum, 58°; minimum, 44°—are even lower than they were in the same month in 1896, which in turn were several degrees below those of the corresponding month of its predecessor.

The low temperature had the natural effect on vegetation of causing deciduous trees to lose their foliage rapidly towards the

end of the month. Harvesting operations began in the district about the 7th. On the whole, the crops were a full average, and were generally secured in good condition. The potato crop was, however, below the average in bulk and quality.

October.—Although several misty days and occasional showers were experienced, the weather during the first fortnight was good on the whole. A sharp frost on the 14th was followed for four days by heavy, cold rains and north-east winds. From the 18th until the end of the month, with light, easterly winds, the weather was remarkably fine and dry for the season, despite the fogs which prevailed during the last week.

As there were twenty-three dry days, the rainfall was below the average, only 1·71 inches having fallen. The barometric readings, though extending over a wide range, do not show any specially sharp change. From 29·84 inches on the 1st the pressure rose to 30·22 on the 4th, then it gradually fell to 28·94 on the 16th, on the occasion of the rainstorm. It steadily rose to 30·32 on the 22nd, after which it was a little lower, but fairly steady and high, until the end of the month.

Owing to the limited rainfall and the comparative absence of frost—only 14° were registered over four mornings, of which 9° were on the 14th—the average temperatures are higher by 5° in each case than what was recorded for October, 1896, the maximum or day temperature being 53°, and the minimum 39°.

The sharp frost of the 14th finished the tender plants for the season, and caused the Ash, Elm and other deciduous trees to lose their foliage quickly thereafter. The fine weather during the latter part of the month enabled the root crops to be lifted in very good condition.

November.—With a prevalence of light easterly winds, the weather was fine and dry until the 12th, when for three days heavy, cold rains were experienced, and on the 14th a good deal of sleet fell. Though a few fine days were experienced afterwards, the weather generally was changeable, and towards the end of the month rather stormy, with westerly winds. The rainfall was above the average, as 3·37 inches were recorded. There were seventeen dry days.

The changeable nature of the weather is well shown by the barometric readings. The pressure was steady, and above 30·00 inches until the 10th, after which it was very irregular, with two very marked depressions. From 30·10 on the 10th it fell to 29·10 on the 13th. On the 16th it was up to 29·98, then down to 29·60 on the 17th, then rising steadily till, on the 21st and 22nd, it was at 30·39. From that point the pressure rapidly declined to 28·90, when a severe gale, with rain, took place.

The comparative absence of hard frost during this month was notable. Only on three mornings was any frost registered, and the total amount was only 15°, a somewhat unusual occurrence for November. The average temperatures—maximum, 49°, minimum, 40°—are respectively 3° and 5° higher than those for November, 1896.

Considering the open, mild nature of the weather, none of the precocious-flowering plants showed any sign of growth, even the *Jasminum nudiflorum*, Lindl., which frequently flowers in November, had not a blossom open.

December.—After the first three days, which were fine, with slight frosts in the mornings, the weather was stormy and unsettled, and gales and heavy rain were frequent until the 17th. Then for eight days the weather was frosty, and the atmospheric conditions extremely unpleasant, on account of the prevalence of dense fogs. On the 22nd and 23rd the fog was particularly bad, and as it was continuous for over forty-eight hours, traffic in the city was seriously interfered with. A change set in on the 24th, and, with the disappearance of the frost, the fog cleared off. The last week of the year was stormy and wet. There was a preponderance of westerly winds, and the rainfall was much above the average, the amount registered being 5·56 inches. On five occasions the rainfall in twenty-four hours exceeded $\frac{1}{2}$ inch; the greatest fall for one day was 1·20 inches on the 26th. There were thirteen dry days, the same number as in December, 1896, which, however, had only a rainfall of 4·85 inches.

As in November, the barometric records show a varied and wide range in the pressure. From 29·30 on the 1st it rose to 30·10 on the 2nd, then it rapidly fell till, on the 9th, it was at 28·70; rising steadily, with very little variation, on the 23rd it stood at

30·40; a rapid fall from that point to 28·50 on the 30th marked the widest range of pressure in any month of the year. In no month was the pressure so high, and only on one occasion was it lower, viz., on the 5th March, when it was down to 28·30.

Frost, to the amount of 72°, was registered over thirteen mornings. The three coldest days were the 22nd, 23rd, and 24th, when, during the prevalence of the dense, black fogs, the day temperatures, as indicated by the maximum thermometer, were 34°, 34°, and 30°, while the night or minimum temperatures were 20°, 24°, and 23° respectively. The average maximum temperature was 43° and the minimum 33°—the former 3° and the latter 2° higher than in December, 1896.

Whether owing to the want of ripening or a proper period of rest, the open weather had no marked effect on those plants which are usually characteristic of December, as the *Jasminum nudiflorum*, Lindl., and the Christmas Roses were later in blooming and less profusely flowered than usual. Autumn-planted bulbs, however, started into growth quickly, and in sheltered places the buds of the Common Elder (*Sambucus nigra*, Linn.) and its congeners expanded considerably. Many autumn-flowering perennials also kept growing and flowering intermittently, whilst the grass was remarkably green at the close of the month.

On comparing the records of previous years, it will be noticed that the rainfall of 1897 has been much above the average. The amount registered, 40·22 inches, has been only once exceeded during the past twelve years, that being in 1894, when the rainfall amounted to 41·48 inches. In comparison with what was recorded for 1896, when the amount was 33·90 inches, which is about the average for the district, the excess is very striking. The months in which the highest rainfall was recorded were June with 5·67 inches, and December with 5·56 inches. The occasions when the quantity which fell within twenty-four hours was much over an inch (which is equal to 100 tons per acre), are worthy of special note, viz.:—on 16th June, 1·60; on 11th August, 1·50; and on 27th December, 1·20 inches. The greatest amount for one day in 1896 was 1·22 inches on 9th July.

January proved to be the driest month of the year, its rainfall being only 1·22 inches. In the two preceding years May

was the driest month. There were 205 dry days in the year, whereas in 1896 there were 209.

The following table shows the rainfall registered in those Parks where gauges are placed, in comparison with that of Queen's Park, on whose records these notes are based. It is necessary to bear in mind that difference in altitude and exposure, and other local conditions, affect the results to a considerable degree :—

RAINFALL DURING 1897 IN THE PUBLIC PARKS.

	QUEEN'S.	MAXWELL.	KELVINGROVE.	SPRINGBURN.	ALEXANDRA.	GLASGOW GREEN.
Height of Gauge above Sea-level.	145 ft.	69·1 ft.	48·3 ft.	361 ft.	141·4 ft.	34·7 ft.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
January,	1·22	1·21	1·79	1·77	1·06	1·40
February,	2·85	2·66	2·73	3·07	2·97	2·49
March, ...	4·05	4·14	4·12	3·43	3·50	3·57
April, ...	2·01	1·98	1·85	1·64	1·50	1·69
May, ...	2·66	2·53	2·71	1·93	2·18	2·09
June, ...	5·67	6·19	6·45	5·14	6·43	5·75
July, ...	2·22	1·91	2·27	2·10	2·13	1·90
August,...	5·51	4·70	4·73	5·10	4·59	6·10
September,	3·39	3·02	3·64	3·76	3·11	3·12
October,	1·71	1·84	2·04	1·60	1·85	1·67
November,	3·37	2·87	2·62	2·85	2·55	2·54
December,	5·56	5·33	5·58	5·29	5·30	5·34
Totals,...	40·22	38·38	40·53	37·68	37·17	37·66

Regarding the temperature, there is a similarity in many points with what was recorded in the preceding year. Although six of the months, viz., March, July, August, October, November, and December, had a higher average, the mean temperature (46°) for the year is fully one degree lower. This arises from the frosts in January and the cold winds of the spring months, which tended to keep the temperature low. Frost was registered to the amount of 347° over sixty-one occasions, although the thermometer was at or below the freezing point (32° Fah.) seventy-one times. In 1896 the amount of frost was 331° over sixty-three occasions, and the freezing point was reached seventy-three times. The

similarity is also striking in regard to the lowest reading. On the 18th January it was at 16°, or 16° of frost, whilst 18°, or 14° of frost, was the lowest for 1896, occurring on 23rd January and 23rd December. There were eight days on which the thermometer did not rise above the freezing point. In the previous year this only happened five times. January was the coldest month of the year, there being twenty days on which frost was registered, the amount (143°) being about double that of any other month. The warmest month was August, with a mean temperature of 59°, although July closely approached it with 58°. In 1896 June was the warmest month, with a mean temperature of 57°. The hottest day was the 16th July, when the thermometer rose to 78° in shade. A similar temperature was recorded for 1896. In that year the 16th June was the hottest day. The maximum thermometer was at or above 70° on five days in June, twelve days in July, and ten days in August, or twenty-seven times in all; whereas in 1896 it was only sixteen times, these occurring in May, June, and July.

Several points of interest for comparison are shown in the table on the next page :—

1897.	Queen's Park.	Maxwell Park.	Kelvingrove Park.	Springburn Park.	Alexandra Park.	Glasgow Green.
Thermometer (in shade 4 feet above ground level).						
Highest reading of year,	78° on 16th July	80° on 14th May and 18th Sept.	74° on 15th July	78° on 15th July	82° on 16th and 17th July	88° on 16th and 17th July
Lowest do. do.,	16° on 18th Jan.	11° on 19th Jan.	18° on 18th Jan.	17° on 17th and 18th Jan.	15° on 18th Jan.	15° on 18th Jan.
Number of days on which thermometer fell to freezing point (32°),	71 days	122 days	114 days	104 days	111 days	104 days
Number of days on which thermometer did not rise above freezing point (32°), ...	8 days	14 days	23 days	26 days	11 days	12 days
Degrees of Frost registered—						
January, ...	143° on 20 days	215° on 23 days	175° on 26 days	219° on 30 days	165° on 21 days	160° on 23 days
February, ...	33 " 6 "	73 " 14 "	60 " 11 "	56 " 11 "	62 " 10 "	52 " 11 "
March, ...	27 " 5 "	57 " 13 "	68 " 16 "	55 " 14 "	54 " 12 "	47 " 9 "
April, ...	41 " 9 "	82 " 13 "	66 " 15 "	59 " 14 "	69 " 13 "	55 " 9 "
May, ...	3 " 1 day	17 " 6 "	17 " 7 "	6 " 4 "	8 " 3 "	6 " 3 "
June, ...	...	...	...	...	...	...
July, ...	...	...	...	...	...	...
August, ...	...	...	...	...	...	...
September, ...	...	15° on 7 days	2° on 1 day	...	11° on 5 days	1° on 1 day
October, ...	14° on 4 days	51 " 12 "	17 " 3 days	14° on 3 days	23 " 6 "	25 " 6 days
November, ...	14 " 3 "	36 " 6 "	23 " 4 "	18 " 4 "	23 " 4 "	18 " 3 "
December, ...	72 " 13 "	124 " 16 "	96 " 15 "	52 " 14 "	102 " 16 "	96 " 15 "
Total frost registered,	347° on 61 days	670° on 110 days	524° on 98 days	479° on 94 days	517° on 90 days	460° on 80 days

During the year there was an unusual proportion of easterly winds, as the following records will show:—From the S.W., 110; W., 72; N.E., 94; E., 36; N.W., 15; S., 12; and N., 3 days respectively. Thus, excluding the direct North and South, the Western group shows 192 and the Eastern group 153 times, against 245 for the Western and 108 for the Eastern in 1896. There are no appliances in the Parks for gauging the force of the wind, but high gales were somewhat frequent, especially in the latter part of the year.

In reference to the atmospheric pressure, the records show that the range has been more moderate than that of the preceding year. The lowest reading of the year, 28·30, occurred on 5th March, and the highest, 30·40 inches, on 30th December. Though these extremes were approached on several occasions, they are not so far apart nor are the variations so great as those of 1896, when the highest reading was 30·78 inches and the lowest 28·20 inches; and the pressure that year was seventy-three times above 30 inches and sixteen times below 29 inches, whereas in 1897 it was only on sixty-four occasions above 30 and thirteen times below 29 inches.

In comparing the records many features of similarity are noted in the weather of 1897 and 1896. Although January was colder, there was an absence of very severe frosts, and the early months were comparatively mild. Another somewhat sunless summer was followed by a stormy autumn and a frequency of gales in the closing months of the year. The points of dissimilarity were the cold, hard weather in spring and the excessive rainfall.

Vegetation, which had been in abnormal activity at the close of 1896, though checked by the frosts in January, was, with the mild, open weather of February, about as far forward by the middle of March as it was at the same period of the preceding year, but, owing to the cold, hard winds which prevailed afterwards, growth was much slower, and the development of leaves on the earlier trees and shrubs severely checked. Generally the growth of nearly all trees and shrubs was less vigorous than usual, and very much inferior to that of 1896, when the growth was exceptionally fine and all foliage remarkably luxuriant. Those species of trees which are noted for a showy display of bloom fell short of what was expected, the hard winds not only preventing a proper

development of the flowers, but causing the blooms to drop quickly. The crops of fruits were irregular, and generally below the average.

The withering effects of the cold winds, which were so apparent on arboreal vegetation, were less marked on grass lands, owing to the frequency of showers, which supplied them with the necessary moisture, consequently the growth, though slow, was steady, and there was a full crop of hay; while the cereals made not only a steady and satisfactory growth, but the grain developed well, so that the crops were, though later than in the previous year, better in bulk and quality. The green crops were a fair average, excepting potatoes, which were under in bulk and quality owing, no doubt, to the absence of sunshine and warmth which is so essential to the growth of that useful and indispensable vegetable.

As indicated, the growth made by trees and shrubs was less satisfactory than usual. The prospects of a bright display, therefore, in our woodlands is not great, and rarely is there such a paucity of flower-buds on Rhododendrons and similar shrubs as there is this season. Deciduous plants are somewhat better than the evergreens, but in this district, so far as can be observed, they are not very well set with flower-buds, consequently there is little promise of a fine display of bloom on fruit trees, though it does not always follow that a great amount of bloom means a heavy crop of fruit, as much depends on the quality of the weather when the trees are in bloom for the proper setting of the fruit.

Though our hopes for a season of brilliant sunshine and genial weather were not fulfilled last year, we can again express the hope that the current year will have these desirable conditions, so that in stimulating the vegetation, which in our smoky atmosphere has a severe struggle for existence, the comfort and health of the citizens will be likewise enhanced.

Subjoined is the Meteorological Record for the last three years as kept at Queen's Park, and the averages for the last twelve years.

COPY OF METEOROLOGICAL RECORD KEPT AT QUEEN'S PARK, GLASGOW.

Rain Gauge 145 Feet above Sea Level.

MONTHS.	1895.				1896.				1897.				Averages for the Last 12 Years.					
	Rainfall.	Thermometer. Average.		Dry Days.	Rainfall.	Thermometer. Average.		Dry Days.	Rainfall.	Thermometer. Average.		Dry Days.	Years.	Rainfall.	Mean Temperature.	Dry Days.	Number of Days on which 1° or more of Frost was registered.	Degrees of Frost registered.
	Inches.	Max.	Min.		Inches.	Max.	Min.		Inches.	Max.	Min.			Inches.				
January,	0·58	34	23	21	1·54	43	34	15	1·22	38	29	23	1886	29·96	46	194	97	518
February,	0·14	35	19	23	1·76	47	36	19	2·85	44	35	14	1887	25·78	47	203	97	417
March, ...	1·17	47	35	15	4·21	48	34	12	4·05	47	36	11	1888	32·33	46	190	81	232
April, ...	1·05	54	38	14	1·83	56	38	20	2·01	50	35	19	1889	26·18	47	194	59	250
May, ...	0·20	63	43	26	0·60	63	43	28	2·66	57	40	20	1890	38·04	47	170	74	273
June, ...	1·68	67	46	21	4·07	65	49	16	5·67	62	49	15	1891	36·09	46	184	85	371
July, ...	3·81	64	49	15	3·92	64	49	19	2·22	67	50	21	1892	33·84	45	194	101	798
August,...	6·02	65	52	5	1·64	63	48	20	5·51	67	52	13	1893	33·05	47	186	56	306
September,	1·40	63	49	24	4·71	59	46	10	3·39	58	44	16	1894	41·48	46	169	55	256
October,	2·95	49	35	13	3·70	48	34	17	1·71	53	39	23	1895	27·57	45	202	99	823
November,	4·08	46	37	10	1·07	46	35	20	3·37	49	40	17	1896	33·90	47	209	63	331
December,	4·49	40	33	15	4·85	40	31	13	5·56	43	33	13	1897	40·22	46	205	61	347
	27·57			202	33·90			209	40·22			205	Averages,	33·20	46°	192	77	410

Note on China Grass.

By G. F. Scott Elliot, M.A., B.Sc., F.L.S., F.R.G.S.

[Read 22nd February, 1898.]

China Grass, Rhea, or Rami, is derived from two varieties of a plant belonging to the nettle order, *Boehmeria nivea*, Gaudich.

Its history has been a very chequered one,—fibres have proved disastrous in many cases, and none more so than the Rami. There is a statement that it has been found in the Egyptian tombs as a mummy wrapper, but I cannot trace the authority for this.

It is mentioned in the Ramayana of India, and its possible use as a fibre was pointed out by the botanist Lobel, who flourished in the time of Queen Elizabeth. It seemed to have considerable prospects in 1872, but unfortunately in that year the price suddenly fell from £80 a ton to £24, and after this it seemed to have been quite thrown into the background.

Last year, however, seemed to show that there was a prospect of its really coming forward again, and it is on account of this that I thought that these few notes might be of interest to the Society. The first point is the confusion betwixt *Boehmeria nivea* proper and a variety called *tenacissima*. The true *B. nivea*, or China Grass, can be grown in China, Mexico, *i.e.*, in the temperate zone. Dr. Morris, *e.g.*, states that it can be cultivated at Kew. The variety *tenacissima* is wholly confined to the tropics, and belongs to such places as Java, Sumatra, and Assam. A cold winter is fatal to this form, whilst the true *B. nivea* flourishes in North China, where the winter is severe.

Another difficulty is the confusion of names. The ordinary commercial names seem to be applied as follows :—"Rhea" to the stems or bark with the brown epidermal layer still attached; "Rhea ribbons" to the cortical bark, with or without the

epidermis; "China grass" to the bark deprived of its epidermis and free from gum; "Rami" is a general term applied to the plant itself, or the bark as it comes from the plant.

The cultivation is not difficult except for the germination of the seed, which is a very delicate matter. The yield is given as from 1,500 lbs. to 2,800 lbs. of clean fibre per acre, which contrasts favourably with any fibre plant. Jute is said to give 2,000 lbs. per acre. Flax and hemp give from 400 to 450 lbs. Cotton varies greatly, but never gives 2,000 lbs. per acre.

The real difficulty in Rami is the preparation. The fibres are extremely long, and form a continuous ring round the central column of wood. They are bast fibres of the cortex, and are mixed with a great deal of gummy material. They are also not of uniform length. Many ways have been tried to get these fibres cleanly and cheaply out of the bark. Full details as to the method employed at Wraysbury will be found in a paper in the Society of Arts Journal, by Mr. Cross, who is the leading authority on fibres in this country. (June 25th, 1897, *Journal of Soc. Arts.*)

The Rhea Fibre Treatment Company, which has kindly presented the Technical College in this City with the beautiful case of samples now exhibited, appears to prefer the Rhea ribbons, of which specimens are included. These ribbons are dried strips of the bark, and their production is extremely easy, involving simply a steeping in hot water with a little crude soda, and careful drying for export.

At present it is said that 2,200 tons of China Grass are employed annually, and that there are 31,000 spindles at work upon it in England, Germany, and France. Undoubtedly the extreme silky beauty of the fibre has a great deal to do with its success. It is very strong, about twice to three times as strong as hemp, four times as strong as flax, and eight times the strength of cotton.

In spinning properties it is placed, on good authority, above both hemp and jute, though below flax. This is mainly on account of the variation in length of the fibres, which may be from half-an-inch to about ten inches.

Observations on some Morphological Abnormalities in the Tomato.

By S. M. Wellwood.

[Read 26th October, 1897.]

Among the various vital phenomena to be observed in plants under cultivation, deviations from the normal progression of development are perhaps the most striking. When a wild plant is introduced into the garden, the first effects of the improvement of its circumstances are shown in a greater luxuriance of foliage, and generally in an increase in the size and beauty of the flower. After the plant has apparently reached its maximum in a normal direction, continued culture, especially when accompanied by an increase in the amenities of environment, leads to developments of an abnormal nature. The most familiar example of these abnormalities is seen in the doubling of flowers, where not only are the essential organs of the flower metamorphosed into petals, but the transformation is generally accompanied by an indefinite multiplication of the floral whorls. In the case of plants of tropical or sub-tropical origin cultivated under glass, additional factors, such as differences of climate and food supply, artificial selection, and special cultural treatment with a view to a particular result, produce conditions which are highly favourable to deviation. The cultivator, by prescribing the environment, wields an immense power, and the character and constitution of the plant, within certain limits, is at his mercy to make or mar. Generally he seeks to gain the maximum of flowers or fruit with a minimum of vegetative growth, but very often a high cultivation produces modifications other and less desirable than those aimed at. In some cases it is the object of cultivation to encourage deviation. For example,—in the metamorphosed and abortive inflorescence

of the Cauliflower, and in the fasciated inflorescence of the Cockscomb, advantage is taken of the inherited tendency of the plants to produce these abnormalities.

It is generally admitted, however, that where malformation is present, disease may be looked for as a natural sequence. Some authorities are of opinion that the cultivation of fruit trees has resulted in an enfeeblement of their vegetative organs, and a shortening of the duration of their lives. It may be assumed that all cultivated plants are, to a certain extent, disposed to deviate in one way or another from their ordinary structure, and it cannot therefore be wondered at that they are so liable to malformations and diseases.

Although the abnormalities of the Tomato [Pl. II.] are not without parallels in the vegetable world, under certain conditions they are, I think, so excessive, varied, and unusual in a plant so highly organised as to be worthy of special notice. Gardeners are familiar with these phenomena, to which they pay little attention further than removing superfluous growths wherever they appear. The causes which lead to these manifestations are not far to seek, but biological questions arise which might prove worthy of the attention of the student.

Some years ago I grew a few Tomato plants, and, observing during their development some abnormalities of a striking nature, I determined, when a suitable opportunity should arise, to prosecute my observations on a larger scale. This year I have been able to do so. Through the kindness of Mr. James Barr, of Rosebank Nurseries, I have made continuous observations on the growth of over 2,000 plants in his Tomato houses from their earliest stages. In addition to this, some thousands of plants have been examined in the houses of growers in various parts of the country.

The Tomato, *Lycopersicum esculentum*, Mill., is an annual of straggling habit, producing many trailing succulent stems, not unlike "potato shaws." The natural order, Solanaceæ, to which it belongs is one of the largest of the orders of flowering plants. It has representatives, showing a considerable range of variation, in almost every climate, and reaches its highest point in numbers of genera and species in the tropics. Although the Tomato was introduced into this country from South America at an early date,

it is only of comparatively recent years that it has attained popularity. The Love-apple, as it used to be called, was cultivated more as an object of ornament and curiosity than as an edible fruit.

The adventitious developments are no doubt due to the methods adopted by the gardener in cultivation. It is more than likely that adventitious growths are as rare in the Tomato in its wild state as in any other plant, and it is certainly the case that plants left to themselves exhibit little or no abnormality. The Tomato under glass is a rampant grower, and the first great principle in its successful culture is pruning.

The best plants are produced from seed, although it will "strike" readily from the "hard" cuttings which are sometimes produced from the base of the stem. The successful cultivator confines the plant strictly to one stem, the lateral shoots being removed as soon as they make their appearance. In addition to this, after the first bunch of fruit is set, most gardeners shorten the leaves by half their length.

During what Vines terms the "grand period of growth in length" the exuberance of the plant is enormous. The excessive vitality, "cabined, cribbed, confined" by the severe pruning, finds vent in many ways, and the effect of the drastic treatment to which the plants are subjected is somewhat remarkable.

A good working hypothesis is found in the well-known theory originally propounded by Goethe, that all the organs of the higher plants can be referred back to a very small number of fundamental forms; that, in fact, every organ is either axial or foliar, or is compounded of these two.

In most plants the respective functions of the stem and leaves are as well defined as are the external forms of these organs. Exceptions are found in Cacti, Ruscus, &c., where the stem performs the functions of the leaves; and in Bryophyllum and others, where the leaf, by producing buds, undertakes the functions of the axis. The artificial propagation of the plant from the leaf is a common operation performed on Begonias and other plants, but the most remarkable example of the transformation of the leaf into an axis of growth is displayed by the Tomato. The leaf is interruptedly pinnate, the proportion of inferior to superior pinnæ varying considerably in different varieties, but generally

there are two pairs of inferior pinnæ to every pair of the superior. Very often at the base of the superior pinnæ a sessile leafy process may be observed, and in its axil a bud, which under favourable circumstances will develop into a branch. In almost any leaf a protuberance will be found at these points on the rachis. A microscopical section through this protuberance presents all the appearance of a bud in its earliest stage, and a series may be made showing the tissue in all stages of development. Sometimes these buds remain dormant, but on removing the upper part of the stem, and checking all lateral growths, the whole energy of the plant is directed to these buds, and in a short time the plant presents the remarkable appearance of a leaf, or leaves, bearing branches, which flower and bear fruit.

On seeing this phenomenon for the first time, it might be assumed that the adventitious growths on the leaf resulted from the severe pruning of the plant on which they appear, but this is not the case, as the buds may be observed on the rachis of the leaf more or less developed before the plant has been pruned at all. This abnormality is the most important one to be observed in the plant. It is by no means characteristic of the order, and the fact that it produces buds on the leaves before cultural mutilation, seems to point to constitutional changes induced by cultivation.

The other abnormalities to be described are not uncommon in cultivated plants, but considering that the Tomato produces abnormalities at every available point, the fact may be looked upon as nature's protest against overculture, and should serve as a warning to the cultivator. The Tomato is subject to many diseases, the most deadly of which is the fungus *Cladosporium fulvum*, which seems to be spreading throughout the country with great rapidity.

The following is a list of the abnormalities which have come under my notice :—

Adventitious roots on the stem are formed as far up as 18 inches from the ground.

Abnormalities of the stem and lateral branches.—Fasciation of the stem is frequent, and partial fasciation (probably induced by a change in conditions during the progress of growth) is not uncommon.

Adventitious buds on the stem, as in many plants, are common near the base, but on the upper parts all the adventitious buds I have observed are due to injury of the stem.

Of the leaf.—Leafy processes resembling stipules are frequent. In the normal state the plant is exstipulate.

Leafy processes and adventitious buds are formed on the rachis (as in *Asplenium decussatum*).

Of the flower and fruit.—In the normal state the flowers are *ebracteate*, but in some varieties bracts are common.

The normal number of the segments of the calyx and corolla is five each; six and seven segments are more common.

Prolification of the floral axis is extremely common; the adventitious branch may be *terminal*, *lateral*, or *axillary*.

A secondary prolification of the floral axis, after the fruit is well set and nearly ripe, is not uncommon, the development of which is peculiar. This process is generally axillary, and at first presents the appearance of a diminutive and attenuated, but otherwise ordinary leaf. On closer examination it will be found that there is a slight swelling near the centre of what is apparently the petiole of the leaf. From this swollen portion to its base it will be observed that it has the appearance of a stem, in so far as it is perfectly cylindrical, while the part from the swollen portion to the lamina of the leaf is flattened on the upper surface, and generally channelled as in the ordinary petiole of the normal leaf. Further development reveals the fact that this process is in reality a branch, as there is a bud concealed in the tissue of the swollen portion of what might be taken as the petiole of the leaf.

Fasciation of the flower and fruit is common.

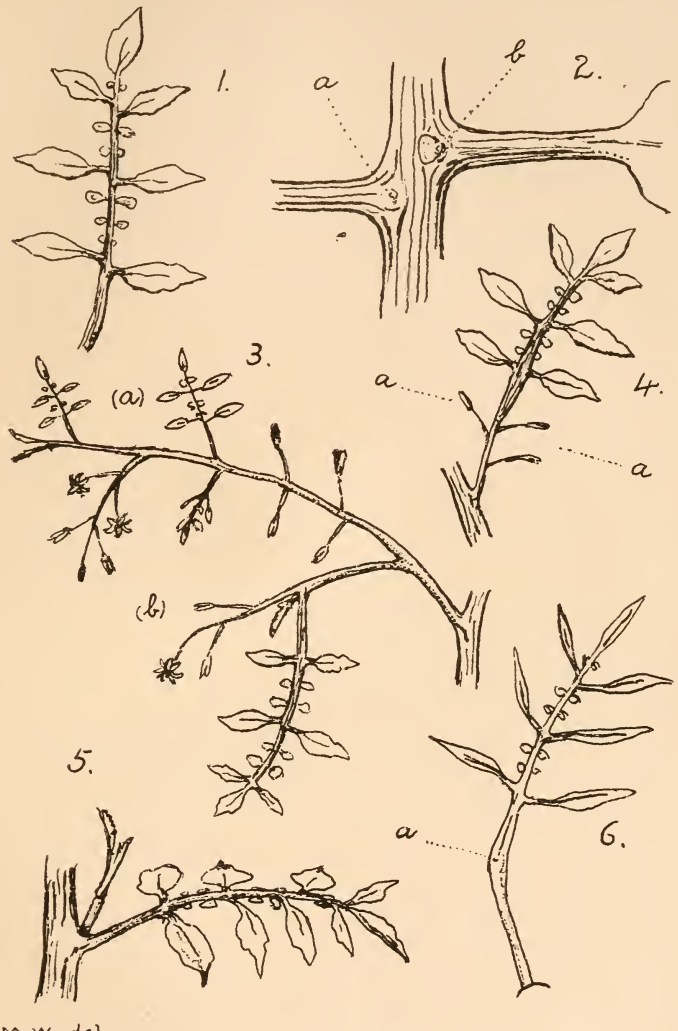
Of the secondary axillary shoots.—The "stopping" of the ordinary lateral branches formed in the axils of the leaves is not sufficient to discourage the exuberance of the plant at these points, and in this connection the following phenomena have been observed:—

(1) Lateral adventitious branches may be formed on one or both sides of the axillary branch that has been removed.
(2) An adventitious branch may be formed in the axil between the base of the branch that has been removed and the petiole of the leaf.

(3) An adventitious bud producing a branch may be formed on the callused apex of the axillary branch that has been "stopped."

It might be thought strange that, in the face of the excessive abnormalities of the leaves and flowers, the fruit, as a rule, should remain normal. But it must be remembered that varieties are cultivated for the fruit alone, and those with badly shaped fruit drop out of cultivation.

As far as my observations have gone, I have found that in every case where malformation and abnormality are excessive, overculture may be looked upon as the immediate cause, and it is a significant fact, that in those houses showing the maximum of abnormality, there was also found the maximum of fungoid disease, the converse being equally true. In no case, however, have I found Tomatoes under cultivation free from abnormality, generally at least two or three kinds on each plant, and invariably (except perhaps on plants which have been absolutely starved), dormant buds as described are found on the midrib of the leaf.



1. Tomato leaf.
2. Portion of same, actual size, showing position of dormant buds at (*a*) and (*b*).
3. Abnormal inflorescence, producing at (*a*) a floral branch terminating in a vegetative shoot, which again produces flowers; (*b*) floral branch, producing a leaf, with vegetative branch in its axil.
4. Aborted inflorescence, caused by the formation of a leaf in the place of the terminal flowers; (*a*) (*a*) aborted flowers.
5. Bud formed on the apex of a lateral branch which has been "stopped."
6. Peculiar adventitious shoot, actual size, formed in the floral axils when the fruit is swelling; (*a*) dormant or abortive bud.

(Figs. 1, 3, 4, and 5 much reduced.)

Occurrence of Sirex gigas, Linn., in Bute and Arran.

By J. Ballantyne, Rothesay.

[Read 26th October, 1897.]

About three years ago my attention was first called to the presence of *Sirex gigas*, Linn., the Giant Sawfly, in Bute and Arran, as a female of this species had been caught in the Rothesay Sawmill, and given to me. A year later other two females were caught in the sawmill, and these I also got.

Last July, while a lighter was discharging Bright Spruce deals at Rothesay, which were part of a cargo brought from Quebec by the ship "Heathfield," a female was caught at the harbour on the deals. The insect is in every respect similar to those which have been caught in the sawmill or reared by myself. There is every reason to believe that it had emerged from the Quebec deals, as some of them had holes as if the larvæ had been living in the timber. This wood is similar to Scotch Fir, but a little more spongy.

When I received the second pair of flies from the sawmill, two years ago, I determined to obtain all the information I could regarding them. In this connection I am deeply indebted to Mr. Thomas Falconer, of the Rothesay Sawmills, who has been unremitting in his efforts to secure specimens and obtain information for me from woodmen and foresters employed in the woods of Bute, Arran, and Ormidale. As a result of these inquiries, it has been ascertained that *Sirex gigas*, Linn., has been known for the last twenty-five years at least, to quite a number of men employed in connection with the sawmill. For example, James Macfarlane says he has often seen the fly when cutting trees. The first time he observed it was about twenty-five years ago at Ormidale, Loch

Ridden, and during the last eighteen years he has often cut through their larvæ in Scotch Fir grown in Bute, and sent to the sawmill by the Bute Estate people to be cut up for themselves. He is quite conversant with the larvæ, and did not mistake it for that of some other fly. Sometimes there are large numbers of the larvæ in the wood, so much so that the saws become "greasy" when cutting through them. At other times they are fewer in number, but nearly every season they notice some of them. Several of the foresters and woodmen say they have often seen the fly, sometimes two or three together, flying about or resting on the timber in various of the woods throughout the island of Bute, during all the years they have been working in them.

Walter Swan, who has been employed as wood foreman in Arran for the last twelve years, says he has often seen the fly in Merkland Wood, near Brodick Castle, Arran—frequently two or three at a time, and single ones so often that he paid little attention to them. Larvæ are invariably obtained in the timber brought to the mill from this wood.

It would therefore appear, that for many years this fly has been observed regularly in Bute and Arran, and also in wood at Ormidale, Argyllshire.

Early in May of the present year, while some Scotch Fir from Merkland Wood, Arran, was being cut in the sawmill, one tree was found to contain a large number of larvæ, and I have pleasure in submitting for your inspection pieces of the wood, along with larvæ and insects obtained from it. You will observe how the larvæ have filled up their borings, as they proceeded, with the refuse from the wood. This refuse is packed quite hard in the tunnels by the larvæ.

The insect appears to deposit its eggs with its strong ovipositor in the wood underneath the bark. When the eggs are hatched the young larvæ begin to feed on the wood of the tree, and, in doing so, bore these holes through the timber. When the larvæ are present in large numbers in the trees, the wood may be so riddled by their borings as to make it quite useless for any purpose but firewood. The local trees, however, have never been found wholly damaged to this extent. The larvæ are of a creamy-white colour, but are inclined to turn black when preserved in methylated spirits, as you will notice from the specimens shown.

I had these pieces of wood under observation all summer, and at the beginning of August the first flies made their appearance from the wood, through circular openings slightly smaller than the ordinary holes bored in the larval stage.

How long the eggs take to hatch and the insect remains in the larval state I have still to learn. But now that it is known to be a native of some of our woods in the Clydesdale district, data may soon be forthcoming to clear up those points. The places to look for it are where Scotch and Silver Firs grow in some abundance. I am convinced that if more of our woods in other localities were properly examined the fly would be found in them too.

Trees which have begun to decay should receive careful attention, as the fly seems to attack them in preference to those which are healthy and growing. The tree from which these pieces containing the larvæ were taken was partially dead when it was cut down. But whether the eggs had been deposited while it was still standing, or not until it had been cut down, it is difficult to determine. The larvæ do not seem to be able to continue their operations after they have been disturbed or exposed in their borings, but soon shrivel up and die. At least this has been my experience with them, and it prevents observation of their operations, which would, no doubt, prove interesting and instructive.

Notes on the Tipulidæ of the Glasgow District.

By George W. Ord.

[Read 28th September, 1897.]

The following list of Tipulidæ, collected in the West of Scotland during the present summer by Mr. Robert Henderson, of the Andersonian Naturalists' Society, and myself, must necessarily very imperfectly represent the number and distribution of the species in the district, and it is with some hesitation that we present it at all.

The Diptera have been very much neglected by British entomologists. In Scotland matters in this respect are even worse than they are in England. Mr. Verrall, the most prominent English authority on the Diptera, published in the *Entomologists' Monthly Magazine* (Vols. XXIII., XXIV., XXV.) "A List of British Tipulidæ," giving tables for the identification of all the genera, and of the species of the principal genera. Mr. P. H. Grimshaw, of the Museum of Science and Art, Edinburgh, to whom I am much indebted, advised me to get Vol. II. of Schiner's *Fauna Austriaca* (Diptera), and the minute descriptions of species in that splendid work have, in the majority of cases, removed all the doubts we may have had as to the correctness of our identifications. A number of species still remains to which we have been unable to assign positively any specific name, and these we have been compelled to leave over for further study, and in the hope of obtaining fresh specimens next year.

Of those included in the list, only in regard to the species of the genus Molophilus, and to one or two species of Tipula, is there any uncertainty, and of these we can only say, as Mr. Verrall says of many of the species in his list, "we believe we have them." All systems of classification are more or less artificial. I cannot see that the modern method of classifying by the neuration of the wings is less artificial than its predecessors. The neuration exhibited by any single species is by no means constant, as often the two wings of the same insect exhibit striking differences. The

first specimen of *Pachyrrhina maculosa* which I came across puzzled me for a long time because it had an open discal cell, and the only example of *Ephelia miliaria* that I ever captured had the characteristic cross-vein in the second basal cell only in one of its wings; in the other wing there was no trace of it.

The total number of species of Tipulidæ recorded for this country so far is about 160, and of these we have in one season found and identified 49 in the West of Scotland, principally in the neighbourhood of Glasgow. In addition to these we have observed, at any rate, another species of Winter Gnat (Trichocera), and species of Dixa, Empeda, Amalopis, and Peronecera. The Tipulidæ seem to display the same peculiarities of distribution as other families of insects, some being found everywhere, others having a very limited radius indeed. *Tipula lutescens*, for instance, although very abundant on the right bank of the Allander, at Clober, was not to be found on the left bank at all, albeit, for a Tipula, it is very swift of flight. The Milngavie district and the islands of Loch Lomond have supplied us with most of the rarer and striking species, and it is probable that there are as many species of Tipulidæ to be found on the islands of Inchmoan and Inchmurrin as in the whole district. The common name for the Tipulidæ is "Daddy Longlegs;" several of the larger species are known in England as "Crane-flies," and in the North of Scotland as "Spinners," from the peculiar noise they make when rising from among the grass. The Lanarkshire name is, I believe, "Jenny Meggies." The terms "common, abundant, &c.," used in the list, refer only, of course, to the present year.

Ptychoptera contaminata, Linn.—One example of this species was taken at Mollinburn on the 30th May, and a second on the banks of the canal, at Possil Marsh, on the 25th June. These were all that were obtained during the season. Both were males, and were got by sweeping.

Limnobia nubeculosa, Mg.—Appears to be fairly abundant and well distributed, and also to be found throughout the season, from May to September. First taken at Steps Moss on the evening of 7th June by sweeping, and three evenings later at Cadder Wilderness. Found very abundantly on Inchmurrin, Loch Lomond, on the 19th of the same month, under the eaves of a sheep-house. Swept at the Linn of

Baldernock as late as the 18th September. Other localities are Clober, Fintry (Stirlingshire), and Tarbert (Lochfyne). This is the only representative of the large genus Limnobia which we have obtained so far.

Dicranomyia chorea, Mg.—Apparently common and well distributed, but we obtained no specimens after the middle of July. Earliest record 3rd June, at Cadder Wilderness. Flies about trees and bushes after the manner of the gnats. Other localities are Steps Moss, Milngavie, and Kirn.

D. stigmatica, Mg.—Has the same habit, and frequents the same localities as the last; is probably as common. Steps Moss, 7th June; Milngavie and Kirn.

D. lutea, Mg.—A single specimen was taken by sweeping on Inchmurrin on 19th June.

D. dumetorum, Mg.—Several examples of this species were obtained on Inchmurrin on the same date. They frequented the same sheep-house as *Limnobia nubeculosa*. Not obtained elsewhere.

D. didyma, Mg.—On the 18th September several specimens were swept from the overhanging vegetation at the Linn of Baldernock.

Goniomyia tenella, Mg. — Inchmurrin, 19th June. Several specimens.

Molophilus appendiculatus, Staeg.—One taken on Inchmurrin, 19th June, by Mr. Henderson.

M. propinquus, Egg.—This is probably the commonest species of the genus in the district; but curiously enough only one specimen has been preserved, taken at the Linn of Baldernock on the 6th June.

M. bifilatus, Ver. — Inchmurrin, 19th June. It is with considerable hesitation that any of the species of Molophilus are inserted in the list, as the identification rests on points always difficult of investigation. We have taken Molophili in every locality we have yet visited.

Rhyphologhus nodulosus, Mcq.—This is an early species, but is well distributed, though by no means common. First taken by sweeping at Mollinburn on the 30th June. Other localities are Inchmurrin, 19th June; Clober, 27th June. Not seen after the end of June.

R. similis, Staeg.—Two of this species were swept into the net at the same time as *Ptychoptera contaminata*, on the banks of the canal, at Possil Marsh, on 25th June.

Erioptera flavescens, Linn.—Was flying abundantly among the rushes at the Linn of Baldernock on 6th June. Not observed elsewhere.

E. tænionota, Mg.—Common at Clober on 25th and 27th June. Also taken at Possil Marsh and Giffnock in the same month.

E. fuscipennis, Mg.
E. trivialis, Mg.
} Among the contents of the sweep-net on the banks of the Allander on 27th June both species were obtained. *E. trivialis* had previously been taken at Mollinburn on the 30th May.

Idioptera pulchella, Mg.—On the 20th May we obtained two examples of this beautiful species on Inchmoan, Loch Lomond. It seems to frequent rushes.

Ephelia miliaria, Egg.—One specimen at Mollinburn on 30th May; a female.

E. marmorata, Mg.—One on Inchmurrin, 19th June; a male.

Trichocera regelationis, Linn.—Alexandra Park, March.

Limnophila meigenii, Verr.—Inchmurrin, 19th June. Several specimens were obtained.

L. dispar, Mg.—Common at Possil Marsh on 25th June, and at Clober on 27th. Flies among the rushes and sedges, and does not rise high.

L. lineola, Mg.—Inchmurrin, 19th June.

L. lineolella, Verr.—Common on Inchmurrin on 20th June, and at Clober on 27th June and 4th July. Haunts the Alder.

L. discicollis, Mg.—Several were netted at Steps on 7th June.

L. nemoralis, Mg.—Perhaps the commonest species of all the Limnobiadæ. First obtained at Crookston on the 13th June, and subsequently in almost every locality visited. It is particularly abundant on the banks of the Allander, at Clober, where a dozen could easily have been netted at one sweep on the 25th and 27th June. Not observed after the middle of July. Other localities are—Possil Marsh, Cadder Wilderness, Drymen Road, Kirn.

L. pilata, Wlk.—Banks of Allander, 27th June.

Pedicia rivosa, Linn.—This insect, although very local, appears to be widely spread in the district. Two specimens were brought to us from Fintry, Stirlingshire, in the beginning of July. Subsequently two were taken at Clober on the 27th of the same month, another at Baldernock on the 4th August, while it was also taken at Kirn by Mr. Henderson. Mr. Grimshaw, of Edinburgh, who identified the first specimen taken, described it as local. A high-flying but slow insect.

Liogma glabrata, Mg.—Two flew out of an Alder Tree on the north side of the Allander, at Clober, on the 27th July. They flew rather high, and some difficulty was experienced in netting them. Very like Pachyrrhinæ in appearance.

Pachyrrhina maculosa, Mg.

Pachyrrhina histrio, F.—Both of these species are widely distributed in the district, though they can scarcely be called common. They haunt fields and roadsides, and fly rather low. *P. maculosa* was first obtained at Mollinburn on 30th May, and *P. histrio* at the Linn of Baldernock on 6th June. *P. histrio* seems to fly longer than the other species, for we have found it at various times up to date, the latest having been sent to me from Fintry at the end of last week.

Localities for *P. maculosa:* Linn of Baldernock, 6th June; Inchmurrin, 19th June; Possil, 25th June; Clober, 6th July; Kirn, Troon, &c.

Localities for *P. histrio:* Cadder Wilderness, 30th June; Inchmurrin, 20th June; Milngavie, Fintry, &c.

Tipula nigra, Linn.—The male was very common on two small patches of rushes on the Allander Bank on 27th June, 30th June, and 1st July. Although I went specially on the two latter dates to try and find the female, not one could be got. This species not observed in any other locality.

T. obsoleta, Mg.—Fairly common in the early part of June; Cadder Wilderness, 3rd June; Drymen Road, &c.

T. confusa, V. de Wulp.—A late species, not appearing till the end of August. Very often found on walls or on trunks of trees.

T. longicornis, Schum.—An exceedingly common species about the end of June and beginning of July. Localities: Possil Marsh, Crookston, Cadder Wilderness, Clober, Kirn, &c.

T. hortensis, Mg.—Verrall, in his paper in the *Entomologists' Monthly Magazine*, Vol. XXV., p. 25, says, "I do not at present recognise *T. hortensis*, Mg." A species which, in all respects, answers to the description of *T. hortensis*, was very common in this district in May, especially in the neighbourhood of Milngavie. We found it principally on the roadsides. Localities are—Milngavie, 6th June; Baldernock, 6th June; Crookston, 13th June; Cadder Wilderness, Kirn, &c.

T. melanoceros, Schum.—On Inchmoan, Loch Lomond, 19th May; and banks of Allander, 23rd May.

T. pruinosa, W.—Found this species in fair abundance on the moors around the Whangie, on 5th June.

T. lunata, Linn.—This is apparently a common and well-distributed species, appearing early in June, and continuing to fly during the greater part of July. Shettleston, 20th June; Possil, 25th June; Kirn, Milngavie, &c. Observed on shores of Loch Eck on 22nd July.

T. lateralis, Mg.—A single specimen was taken at Clober on the 23rd May. Not seen elsewhere.

T. vernalis, Mg.—An early and easily distinguished species, apparently widely distributed in the district, flying in grassy parks. Linn of Baldernock, 6th June; Bellahouston Park, 13th June; Crookston, 13th June; Possil, 25th June. Not seen after the end of June.

T. vittata, Mg.—This is undoubtedly the capture of the season, and I am pleased to say that there can be no doubt as to its identity. Mr. Henderson and myself have gone carefully over the description given by Schiner—*Fauna Austriaca* (Diptera)—and find our capture correct in every respect. There can be little question at any time about the identification of an insect so distinct as this species. A single specimen was taken by me at the Linn of Baldernock on 6th June. Verrall mentions that the Rev. E. N. Bloomfield had found it near Hastings, but I have been unable to find any other record, English or Scotch.

T. gigantea, Schrk.—Only three of this species have been observed this year, though in other seasons they have been noticed in tolerable numbers, and I have even seen them at rest on the walls of the Waverley Hotel, Sauchiehall Street. The localities

for this year are—Linn of Baldernock, 6th June; Crookston, 13th June; Inchmurrin, 19th June. The Crookston specimen was a male, the other two were females.

T. lutescens, F.—This large and handsome species seems to be very local. From the 24th June till the end of July it was exceedingly abundant on the marshy ground and in the woods on the north side of the Allander, at Clober. The only other locality where it was met with was Tarbert, Lochfyne, where a single specimen was secured on 25th August. *T. lutescens* seems to be much more infested by parasites than any other species. I caught a specimen at Clober, the thorax of which was completely covered with mites, and their scarlet colour gave it a very brilliant appearance in the sunlight.

T. oleracea, Linn.—In other parts of the country this is a very abundant and destructive insect, but it certainly was by no means common with us this year in the perfect state. We obtained a few specimens at Crookston on the 13th June, and at Kirn on the 20th *idem*. It was also brought to me from Troon and Fintry about the same time, but none was seen after the end of June.

T. paludosa, Mg.—This is the commonest species of the whole genus, and shares with *T. oleracea* the name of Crane-fly. It did not appear till the middle of July, but after that it simply swarmed, and is still on the wing. I need not specify any localities, for very little difficulty will be found in getting it even in Glasgow itself. It did not appear until some weeks after *T. oleracea* had disappeared, and this lends some colour to Mr. Verrall's theory that the two are only seasonal forms of the one species. The only differences that can be detected are the short wings of the female *T. paludosa*, and the want of the white streak below the costa so conspicuous in *T. oleracea*.

T. ochracea, Mg.—This species appears to be very local with us. It was very abundant on the Caddercuilt Road on the 26th June. Mr. Brand, a member of the Andersonian Naturalists' Society, brought me a boxful from that locality. Kirn, 20th June; Milngavie, 27th June.

Dictenidia bimaculata, Linn.—A female, in Bellahouston Park, 13th June.

From Photograph by *John Fleming.*

NATURAL ARCH, "SHIP" ROCK, SANDA.

From Photograph by *John Fleming.*

NEST OF GREAT BLACK-BACKED GULL (*Larus marinus, Linn.*) ON GLUNIMORE.

Report of a Visit to Sanda and Glunimore.

By John Paterson and John Renwick.

[Read 28th June, 1898.]

On several occasions small parties representing this Society have been the guests of one of our members, Mr. Andrew Bain, in his yacht, the s.s. "Romany," and have had the advantage of visiting places which are not easily got at, unless by means such as those which Mr. Bain has kindly placed at our command. Sanda, as a place which has never been reported upon at any length in its natural history aspects, has claimed our attention in the present year, and this report refers to a visit to that island and the interesting knuckle of conglomerate, Glunimore (literally "The Big Knee"), which lies to the north-east of it. On the morning of the 2nd of June we slipped down from Campbeltown, but when clear of the land, as we approached Sanda in a N.W. gale, it became a little doubtful if it would be practicable to land, and, as we had been disappointed in our intention of visiting Ailsa Craig on the previous day, we were not unprepared for the worst. However, in a bay behind the lighthouse we got a good anchorage and some shelter, and our party were quickly ashore. Sanda is not an island distinguished in any way in its physical features, unless the natural arch [Pl. III.] near the lighthouse can be held to justify the claim. It is only a "green isle of the sea" like many others around our coasts. From its resemblance to an upturned spoon, the people in the south of Arran call it "An Spang" or "The Spoon." "It lies at the west side of the entrance of the Firth of Clyde, $1\frac{3}{4}$ mile S.S.E. of the nearest part of the peninsula of Kintyre . . . and has an utmost length and breadth of $1\frac{1}{4}$ and $\frac{3}{4}$ mile" (*Ordnance Gazetteer of Scotland*, Vol. VI. Edin., 1885).

Although tame in aspect, and covered with good grass and some heather, the visitor notes the evidence of its storm-swept situation in the divisions of the fields all being made with ships' timbers, with the bolts in them in many cases. The little burial-place contains, besides the ruins of a chapel dedicated to St. Ninian (although the dedication is also claimed for St. Columba and St. Adamnan), at least two remarkable stones of great antiquity. The first of these to catch the eye is a "pillar of rude, lumpish type, without a vestige of ornament, and roughly shaped into the figure of a cross," and to it "we might perhaps venture to attribute a possible antiquity far exceeding that of the adjoining stone building, with its piscina and *benitier*. Such primitive-looking monuments are occasionally to be met with, principally in isolated spots, as the remoter western isles, &c. They carry the mind back to times when the little cell or oratory was constructed of wattles, long ere the *réligieux* had time or thought to bestow upon the marvellous sculpturings of a later mediæval age" (*Archæological Sketches in Scotland, District of Kintyre*, by Captain T. P. White. Edin. and London, 1873, p. 84).

The other monument is extremely ornate in character, but the corroding tooth of time, and the lichens encrusting its sculpturings, have combined to obscure its story, while giving it a new beauty. It is a large slab, "seven feet by two," and a curious feature at the intersection of the arms of the cross is a central "cup-shaped hollow, encircled by four similar hollows, one at each angle, the five making a pretty pattern of a St. Andrew's Cross." . . . "This slab," Captain White says, "is probably of early type, though, as I have remarked, of quite a different class from its unadorned neighbour."

MAMMALS.—We saw nothing of any land mammal during our brief visit, and, according to the lighthouse keepers, the only mammal they have is a shrew. Since our return one has been received in the flesh by Mr. Hugh Boyd Watt from one of the light-keepers. It proves to be the Lesser Shrew (*Sorex minutus*, Linn.), which is the shrew of the Hebrides.

BIRDS.—In this class the list is headed by the hardy Blackbird (*Turdus merula*, Linn.), of which several were seen. There

being neither trees nor hedges on the island, its choice of a nesting place is limited, and one which was seen in a cave was a curious structure. To prevent the nest falling from a sloping ledge, the bird had to make two great wings to the nest proper—a mass of rootlets extending three times the diameter of the nest on each side of the central structure. Several Wheatears (*Saxicola œnanthe* (Linn.)) were seen, and the Wren (*Troglodytes parvulus*, Koch), which was common, heralded its presence before we had landed on the island. A Pied Wagtail (*Motacilla lugubris*, Temm.) was seen in the lighthouse keeper's garden. Several Meadow Pipits (*Anthus pratensis* (Linn.)) were seen, and the Rock-Pipit (*A. obscurus* (Lath.)) was common. A House-Martin (*Chelidon urbica* (Linn.)) was the only hirundine observed. The Starling (*Sturnus vulgaris*, Linn.) was the most abundant bird on the island. The Jackdaw (*Corvus monedula*, Linn.) was very common, and although we were not so fortunate as to see the Raven (*C. corax*, Linn.), a clutch of eggs of this species taken in 1895 was exhibited in the year mentioned to the Andersonian Naturalists' Society. The Hooded Crow (*C. cornix*, Linn.), we were informed by the light-keepers, is sometimes seen. Of the Carrion-Crow (*C. corone*, Linn.) we saw a pair, and found the remains of one on the shore. Mr. W. Eagle Clarke, who visited Sanda on the 5th of June, 1897, has kindly sent us a list of the birds observed by him on that occasion. His list adds four species to those seen by us—the first of these to be named is the Sky-Lark (*Alauda arvensis*, Linn.), several being noted. The Peregrine Falcon (*Falco peregrinus*, Tunstall) was observed. A clutch of eggs of this species, taken on Sanda in 1895, was exhibited in November of that year to the Andersonian Naturalists' Society. Mr. Clarke's list includes the Kestrel (*Falco tinnunculus*, Linn.). The Cormorant (*Phalacrocorax carbo* (Linn.)) was common in the waters round the island, and the same remark applies to the Gannet (*Sula bassana* (Linn.)). A pair of Common Sheld-Ducks (*Tadorna cornuta* (S. G. Gmel.)), a small flock of Mallards (*Anas boscas*, Linn.), consisting of seven drakes and one duck, and a pair of Red-breasted Mergansers (*Mergus serrator*, Linn.) were seen a little east of St. Ninian's Chapel. The Rock-Dove (*Columba livia*, Gmel.) was noted, but more were seen on Glunimore. A solitary Red Grouse (*Lagopus scoticus* (Lath.)) was the only game-bird seen.

Mr. Clarke's list includes the Corn-Crake (*Crex pratensis*, Bechst.), one being heard by him. Mr. Clarke also saw a single Ringed Plover (*Ægialitis hiaticula* (Linn.)). The other representatives of the Limicolæ were a few Lapwings (*Vanellus vulgaris*, Bechst.) and several pairs of Oystercatchers (*Hæmatopus ostralegus*, Linn.). A nest and eggs of the last-named species were found near the lighthouse. A flock of about twenty Curlews (*Numenius arquata* (Linn.)) was seen under the lee side of the island, where the ducks were. The Herring-Gull (*Larus argentatus*, Gmel.) was the only one of its kind seen around the island. Leaving Sanda, we passed between Paterson's Rock and Glunimore Islet. Here the "Romany" was brought to, as we wished to explore Glunimore, there being many gulls on and around that islet. A four-oared boat was launched, but on approaching the island unlooked-for difficulties presented themselves, and it appeared doubtful if we would succeed in landing. We were disappointed at the first trial, but, after some manœuvring, we succeeded in our second attempt. The island is surrounded with tangle-covered reefs through which channels run, but these are narrow, and with the N.W. gale that we had to contend with, there was some difficulty in landing. The result of our visit was most gratifying to the ornithologists present. The Blackbird was found even on this small rock, and we came across an empty nest of this species. The Rock-Pipit was represented by several birds. The Jackdaw was noted, and a considerable number of Rock-Doves—eggs of the last-named species also being found. The Cormorant was very abundant, there being 20-30 birds in sight, and we were very much disappointed not to find any trace of nests of this species, as there can be little doubt but that it nests somewhere in this neighbourhood. The Oystercatcher was also represented on this island. A conspicuous feature in the bird life here was the number of Herring Gulls inhabiting the rock. There is a colony nesting here which can hardly be short of fifty pairs—the largest colony in the Clyde area as far as we know. Although this species nests on Ailsa Craig, it is there much inferior in numbers to the Lesser Black-backed Gull. We found on Glunimore about thirty nests, in about a dozen of which the young were hatched out. We saw further three Great Black-backed Gulls (*Larus marinus*, Linn.), and were fortunate in finding the nest and eggs of this

species [Pl. III.], of which a successful photograph was taken by Mr. John Fleming. Mr. John Robertson had the good fortune to raise a Black Guillemot (*Uria grylle* (Linn.)) from her nest and two eggs in a crevice of the rock. Only a pair of birds of this species was seen in the neighbourhood of Glunimore. Mr. Gray, in *The Birds of the West of Scotland, &c.*, in enumerating its breeding places on the West Coast, mentions Arran as one (p. 427), but on the following page he says—"A few pairs are seen in the Firth of Clyde, and occasionally a stray bird is detected in the vicinity of Ailsa Craig. I have hitherto failed, however, to ascertain that it breeds there." In the *Zoologist*, February, 1894, Vol. XVIII., p. 55, Mr. Robert Service states that "it breeds at Ailsa Craig," but gives no particulars.* However, even should this not prove to be the first and only properly authenticated instance of the nesting of *Uria grylle* in the Clyde area, it is at least an interesting addition to our knowledge to have found it at Glunimore.

MOLLUSCS.—In the burial-place at St. Ninian's Chapel, on Sanda, *Helix aspersa*, Müll., was found.

GEOLOGY, &c.—So far as was observed during our brief visit, the island appears to be mainly composed of sandstone and conglomerate, with thin beds of shale, and a band of cornstone towards the north-east.

The strata dip at a high angle to the south, 40° in the eastern part of the island, as seen at Elbow Point, and 30° farther west, as seen near the lighthouse, which is situated at the extreme south on a projecting point formed by a high rock, called the Ship Rock, from its resemblance to a ship under sail. The conglomerate, being harder than the sandstone, has, of course, been less worn away by denuding agents, and forms ridges in the central part of the island, where it alternates with sandstone and shale, while in the eastern part it rises to the height of 405 feet above sea-level.

* Mr. Service writes, that though he certainly saw the Black Guillemot at Ailsa several times on the occasion of his visit, he can recall, at the time of writing, no more definite authority for its breeding on the Craig than the statements of Gray (*Birds of Ayrshire and Wigtownshire*, p. 49). Gray, alluding to the Scaur Rocks and Ailsa Craig, says that it is "probably a native of both places."

Since our return we have learned from the Geological Survey Map* that the rocks are of Lower Old Red Sandstone age, that the cornstone overlies the conglomerate, and that four faults traverse the island across its shorter axis. Two run nearly north and south, one towards the east has a N.N.W. and S.S.E. direction, and the fourth, in the south-west, runs N.W. and S.E.

To these faults, the existence of one of which we had suspected, is partly due the differences in the aspect of the island, by bringing to the surface beds of different degrees of hardness. The high dip of the strata gives what is called a tumulated appearance.

In the New Statistical Account of the Parish of Southend, to which Sanda belongs, it is stated that "The island of Sanda is composed chiefly of sandstone, and the sandstone of which it is composed is elevated to the north, the dip being to the southward, and varying from 15° to 20°. It thus forms hills of about 300 feet in height, which, on some of the shores, are broken into cliffs of moderate elevation. One of these forms a very picturesque object, presenting a natural arch of considerable dimensions. The rock is reddish-grey, and is interstratified with slaty clay of various colours, but chiefly of a grey hue. It has been largely used in the building of the Parish Church of Southend, and several principal houses in the country."

In this account the angle of the dip and the height of the island are both under-estimated.

The natural arch [Pl. III.], near the lighthouse, is certainly most picturesque. Its origin probably dates back to a time when the land stood at a lower level relatively to the sea than it now does. The first breach may have been made by the waves acting along the joints of the rock. Since the sea retired, the wasting has been continued by other denuding agents, and in the course of centuries large blocks have been broken off from the top of the arch and piled in wild confusion below. The arch is thus rising higher, and is likely eventually to disappear.

Other evidence of the altered levels of sea and land is afforded by a raised beach, which does not look quite 25 feet above the present one. At the head of the bay on the north side of the island, this raised beach is covered by blown sand, which is ridged

* *The Geological Survey Report*, which includes Sanda, is not yet published.

up in front of the ruins of the old chapel. The little burial-place occupies part of the ridge, the last named being breached to the west of the chapel by a small stream. The sand is nearly all covered with vegetation, and its tendency to further encroachment is thus checked.

Quite possibly it is to this sand-covered shore that the name of the island is due. Sanda Roads, of which the bay is the inner portion, was a favourite resort of the Norsemen seven to ten centuries ago; and this island is quite likely to have been distinguished by them as the *Sand-ey*, sand island, just as that at the south end of Arran was called, from its flatness, *Fladda*, flat island, altered by the Gael into *Pladda*. In the Orkneys there is a *Sanday*, sand island; and in the Hebrides *Fladda* still retains its proper Norse spelling. In Arran the sandy shores of the bay to the north of Corrie gave rise to the name *Sannox* = *Sand vik*, sand bay. Another name for Sanda is *Sanderey*, which may mean *Sand eyrr ey*, Sand beach island, similar to *Irland* in Orkney and *Ireland* in Shetland, both meaning beach island, *land* being the Norse name for a large island.

PLANTS.—The subjoined list is, we believe, very incomplete, as the time at our disposal on shore was limited. The flora presented no unlooked-for features, but we were pleased to see Juniper, which we do not recall having seen on Ailsa Craig, while the abundance of the Sea Spleenwort and the luxuriance of individual plants of this fern we have never seen equalled—

Ranunculus repens, Linn.
R. bulbosus, Linn.
R. Ficaria, Linn.
Cardamine pratensis, Linn.
C. hirsuta, Linn.
Cochlearia officinalis, Linn.
Viola sylvatica, Fries.
Polygala vulgaris, Linn.
Silene inflata, Sm.
S. maritima, With.
Lychnis diurna, Sibth.
Cerastium glomeratum, Thuillier.
C. triviale, Link.
Sagina procumbens, Linn.
**Spergularia marina*, Leb.
Geranium molle, Linn.
G. Robertianum, Linn.
Erodium cicutarium, L'Hérit.
Ulex europæus, Linn.
Trifolium repens, Linn.
T. procumbens, Linn.

* On Glunimore.

Anthyllis Vulneraria, Linn.
Lotus corniculatus, Linn.
Vicia Cracca, Linn.
Prunus spinosa, Linn.
Rubus (sp. ?).
Potentilla Tormentilla, Scop.
P. Anserina, Linn.
Alchemilla arvensis, Lamk.
A. vulgaris, Linn.
Rosa spinosissima, Linn.
R. canina, Linn.
Cratægus Oxyacantha, Linn.
Cotyledon Umbilicus, Linn.
Sedum anglicum, Huds.
Helosciadium nodiflorum, Reichb.
Conopodium denudatum, Koch.
Œnanthe crocata, Linn.
Heracleum Sphondylium, Linn.
Hedera Helix, Linn.
Lonicera Periclymenum, Linn.
Galium verum, Linn.
Bellis perennis, Linn.
Matricaria inodora, Linn.
Senecio (sp. ?).
Arctium majus, Schkuhr.
Cnicus lanceolatus, Hoffm.
Hieracium Pilosella, Linn.
Taraxacum officinale, Web., var. *palustre*, DC.
Sonchus asper, Hoffm.
Campanula rotundifolia, Linn.
Vaccinium Myrtillus, Linn.
Calluna vulgaris, Salisb.
Erica cinerea, Linn.
E. Tetralix, Linn.
Armeria maritima, Willd.
Primula vulgaris, Huds.
Lysimachia nemorum, Linn.
Digitalis purpurea, Linn.
Veronica arvensis, Linn.
V. serpyllifolia, Linn.
V. officinalis, Linn.
V. Chamædrys, Linn.
Euphrasia officinalis, Linn.
Pedicularis palustris, Linn.
Pinguicula vulgaris, Linn.
Mentha (sp. ?).
Thymus Serpyllum, Linn.
Teucrium Scorodonia, Linn.
Plantago major, Linn.
P. lanceolata, Linn.
P. Coronopus, Linn.
Rumex Acetosa, Linn.
Urtica dioica, Linn.
Empetrum nigrum, Linn.
Juniperus communis, Linn.
Orchis maculata, Linn.
Iris Pseudacorus, Linn.
Allium ursinum, Linn.
Agraphis nutans, Link.
Luzula campestris, Willd.
Eriophorum polystachion, Linn.
Carex pilulifera, Linn.
Anthoxanthum odoratum, Linn.
Aira caryophyllea, Linn.
Pteris aquilina, Linn.
Asplenium Adiantum-nigrum, Linn.
A. marinum, Linn.
Scolopendrium vulgare, Sym.
Polypodium vulgare, Linn.
Equisetum arvense, Linn.

Note on Raspberry Roots.

By G. F. Scott Elliot, M.A., B.Sc., F.L.S., F.R.G.S., and Mrs. Fingland.

[Read 22nd February, 1898.]

There are many instances recorded in botanical literature of stems or roots being buried by some peculiarity of growth. For example, Darwin, in *Movements of Plants*,[1] figures a seedling of *Megarrhiza californica* which is buried by the growth of the stalk of the cotyledon. The stem-bud is buried 4-6 inches in this way. The same occurs in the cases of *Quercus virens* and several species of Ipomœa. This is also the case with the seed of the Date-palm (after Firtzsch[2]); the young plant is, by a similar growth, enabled to escape the long, dry season, which would be fatal to it.

In the Autumn Crocus, *Colchicum autumnale*, Linn., the plant is also buried, but the corms gradually sink deeper into the earth through a different mechanism. Each corm-bud is produced at a slant downwards, so that after twenty years the plant is 15 centimetres below the ground. It continues at this level, for the buds now develop horizontally.[3] The Common Dandelion stem is buried in a different manner. Each cell of the root is at first very long, but it becomes afterwards very broad rather than long, and hence the root becomes stouter, wider, and of course is shortened, and drawn down into the soil.[4] This mechanism is very common with plants which have a rosette of leaves close to the soil or rock. The result is, that the leaves are always developed in such a way that they form a flat cushion, underneath which the wind cannot penetrate. The leaves have, in fact, a

[1] Darwin, *Movements of Plants.*

[2] Firtzsch, *Sitz d. Akad. d. Wiss. Z. U. Wien Abtheil.*, 1 Bd. XCIII., 1886.

[3] Rimbach, *Ber. d. deut. Bot. Ges.*, 1897, Bd. XV.

[4] Willis, *Flowering Plants and Ferns.*

windstill chamber, into which the stomata of the under surfaces open, as, *e.g.*, in *Viola atropurpurea.*[1]

Actual dragging down of the stem is found in, *e.g.*, the tubercles of many orchids, which may be buried 6-10 centimetres. It has been recorded for Monkshood, *Ranunculus bulbosus*, Linn., *Lilium Martagon*, Primulas, Auricula, and the Carrot.[2]

Amongst the Rosaceæ, the node of the strawberry runner is drawn a centimetre deep into the soil. The stolons of *Rubus bifrons*, Vest, are also drawn down by the roots, according to Körner von Marilaun.[2]

The explanation given is, that the root contracts or shortens sometimes as much as a third of its length, so that the plant is drawn down. We were examining some roots of the Raspberry near Aikenhead, and found that the older roots were almost invariably thrown into complicated curves and spirals. They develop chiefly in the loose leaf-mould which is scarcely decomposed, and they spread almost horizontally to a considerable distance.

In one case we found what appeared to resemble pretty closely an ordinary tendril. The root had a straight portion and two coils, one on each side. Subsequent examination showed us that such appearances are very common, though not by any means general. With branch tendrils this is due to the revolving of the free parts of the tendril after it has become attached to the support. The result is, that the stem is drawn closer to the branch, and the coiling affords a give-and-take to the wind, which is of some importance.

Darwin's law, that all the parts or organs of every plant, whilst they continue to grow, are continually circumnutating, gives a very simple explanation of the coils and curves of these Raspberry roots.

Once the root end is fairly fixed in the ground, then the free part of the root that is still growing may behave like a tendril, and throw itself into these curious coils. The result is, that the stem parts are drawn into the ground, and a great mechanical advantage is gained. The specimens handed round show the tendril curvature.

[1] Meigen, *Engler's Jahrbuch*, Bd. XVII., 1894.

[2] Körner, *Natural History of Plants.*

There can be no doubt as to the *fact* of these curious curvatures when plants are grown in leaf-mould, or of the advantage which the give-and-take of the root spirals will afford to the stem when shaken or pulled by animals passing through. It is, however, almost impossible to prove that the free part of the roots coils in this way through circumnutation only. The most recent paper by Professor Macdougal,[1] of which we have only seen an abstract, seems to show that, if a stimulus be applied to a very young root cell, its effects may remain dormant for a considerable period. These coiled roots *may*, when very young, have been in contact with stones, and the result would only appear when they are mature. Stones are, however, not common in leaf-mould.

One might also say, that if the young root were ever so slightly coiled, the subsequent contraction described above would accentuate these curves, and produce spirals. But this slight coiling would be simply circumnutation in an early condition.

On the whole, the simplest explanation seems to be that the root, when firmly fixed, behaves in this case exactly in the same way as the tendrils, and the result is a very perfect mechanical adaptation to its surroundings.

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[1] Macdougal, *Botanical Gazette*, Vol. XXIII., 1897, No. 5.

Limits to the Range of Plant-Species.

By G. F. Scott Elliot, M.A., B.Sc., F.L.S., F.R.G.S.

[Read 30th August, 1898.]

When one reflects upon the enormous literature of Botany, with its 300 and more journals appearing regularly, it is by no means easy to understand why such questions as the above require special treatment. Yet it is certainly the case that the whole question of distribution and limiting range of plants deserves a thorough investigation.

The range of a species is probably never definitely and rigorously defined. Along the borders of the country occupied, it is striving to push forth skirmishers into new country, or, in other directions, it may be retreating before species better adapted to existing conditions. It may even be throwing off trial forms and states which may or may not survive.

For example, one Linaria has, almost within the memory of living botanists, travelled over the railway lines of Great Britain; *Tragopogon pratensis*, Linn., has advanced within three years along two to three miles of the Caledonian Railway at Lockerbie; *Mimulus luteus*, Linn., and *Elodea canadensis*, Michx., are both conspicuous examples of species which have, in the historic period, definitely increased their area. Dr. Lange[1] gives a list of 390 species which have in the last 200 years settled themselves in Denmark. On the other side, we know too well how fern-collectors and others have devastated well-known localities, and yet modern agriculture is even more disastrous to many of our wild plants. In fact, in such a country as ours, interruption of range is the rule, not the exception. A heavy gale, or the cutting

[1] Lange, *Bot. Central.*, Band LXXII., p. 277.

down of a wood, may entirely alter the range of a species. Mr. Dow has recorded the disappearance of *Goodyera repens*, R. Br., from Longforgan, and Mr. Smith[1] from St. Fort Wood, through this very simple cause. Drainage, railway and road-making operations, all produce marked, definite, and distinct changes in the flora. In this country the flora is wholly artificial over nineteen-twentieths of the surface; really wild plants are confined to odd corners, banks, shingle-beds, &c.

The best and clearest cases of naturally and definitely limited range are found with certain marine plants. All true halophytes, such as Suæda, Salsola, and *Aster Tripolium*, Linn., have in course of time become adapted to salt-congested ground, and the presence of salt is a *sine quâ non*, in nature, of their existence. If the salt be by any means removed, they are choked out by others, just as the Mangrove is only able to flourish whilst the sea water comes to its roots. When the soil rises above the level of the tide, the Mangroves are choked out by the West Coast Jungle.[2] Yet, even in this respect, one must not be too certain. *Najas marina*,[3] Linn., was a fresh-water plant in the inter-glacial period, it now lives in brackish or salt water; and other plants may be altering their habits.

There are two other cases in which soil is admitted by most people to distinctly limit specific range, viz., in plants confined to peat or limestone countries. Of the two, peat, in my own experience, exercises the more rigorous selection. Yet almost all plants which are found on peat would grow in other places, if they were allowed to do so by the struggle for existence. Such a species as *Potentilla Tormentilla*, Scop., is extremely common, even dominant, on peat, but it also grows perfectly well on other soils. Limestone and chalk plants are not so distinctly limited, for it is only on bare exposed knolls and rocks that the characteristic lime-loving species are found, or, at any rate, only where the limestone can really affect the plant. There are, however, a few plants to whose distribution peat or limestone is of the nature of a *sine quâ non*.

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[1] Smith, *Proc. Perthshire Soc. Nat. Science*, Vol. II., Part vi., 1898.

[2] Colonial Reports, Miscellaneous, No. 3, p. 6.

[3] Krause, *Botan. Centralblatt*, Bd. LXXV., No. 3, p. 66.

It is at least probable that basalt, mica schist, and barren mudstones also have a great effect on the flora in selected cases. For example, a distinct difference is traceable between the flora of Glasgow and that of Kilmalcolm and Bridge of Weir.

For all these plants geological boundaries will, at any rate, have some effect on distribution.

Another group is found only under certain conditions of what, for want of a better word, we may call climate. The depth and regularity of supply of water, and the amount of sunshine and frost, are probably the main constituents of this "climate." Now one climate, the climate of extremes, very definitely limits a good many plants. This climate is found in many places which look at first sight very different, *e.g.*, on the sand and shingle of the sea-shore, the cinders of a railway track, the slopes of a blaes or ballast heap, and the highest and most exposed part of a mountain, where wind and isolation are at a maximum. In all these places a climate of extremes prevails, and it is not at all remarkable that we find many plants on the mountains and on the sea-shore which are totally absent from the intervening country. *Anthyllis Vulneraria*, Linn., and *Hieracium Pilosella*, Linn., are found on railway lines in Dumfriesshire. The same two plants I found recently at 6,000 feet in the Alps. In both places there was this climate of extremes. Hence the range of, *e.g.*, *Senecio viscosus*, Linn., *Linaria minor*, Desf., Tragopogon, and Melilotus has been extended northwards by the artificial effect of man, by his producing these bare rocks and blaes where the suitable climate of extremes exists.

Let us next take Alpine plants, which only grow naturally on the mountains above 1,400 feet. What assistance would river and valley be in the study, *e.g.*, of the range of *Saxifraga cernua*, Linn.? It occurs in one place in Steiermark, in the Himalayas, Thibet, Scandinavia, Siebengeburgen, Alps, Wallis, Tyrol, Carinthia, and our own country.[1] Ball has shown that 17 per cent. of the Alpine species are common to the Arctic regions and 25 per cent. to the Altai.[2] Most of them can be cultivated in gardens, even at sea level, by providing the proper habitat.

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[1] Krasan, *Botan. Centralblatt*, Bd. LXIX., p. 287.

[2] Ball, *Trans. Linn. Soc.*, Ser. ii., Vol. V., Part iv., 1896.

In Dumfriesshire there are but few localities in which these Alpine plants occur. If one were to imagine the peat hags to be an ocean, then the localities of these Alpine plants would be like islands in an archipelago. Within these islands the range is limited by the occurrence of special habitats. One form occurs on bare dry rocks or screes of stones, another on steep slopes of short turf, some only on wet rocks, others in rock crannies or the mud of spring-heads. In the rare places in which a rich accumulation of good loam has taken place, *Epilobium angustifolium*, Linn., will be found, and perhaps Trollius; and so on. Hence the absence of peat soil and the existence of special habitats are the limiting causes for those forms in Dumfriesshire.

The absence of any species cannot be taken to prove anything. The ordinary idea of the origin of these Alpine plants is that they are still, so to speak, on the fringe of the glacial ice. They are supposed to have followed the ice sheet northwards to the Arctic regions, and also up any convenient mountain which kept the proper climate. They were driven north and upwards by invading swarms of European species. But this process took a considerable time, and the retreat was almost certainly very gradual. Hence we should be grateful that during all that long-continued period a perpetual series of appropriate habitats was prepared for our Scottish Alpine plants. The curious Hieracia which we find on isolated rocky places or corries in Dumfriesshire must always have had a rock or corrie of the proper kind to fly to when they were driven, step by step, from lower altitudes during at least 30,000 years.[1] Their absence, even if appropriate habitats exist at present, cannot be taken to prove anything.

The existence of the right insect also appears to limit the range of some of these forms. Many special bumble-bee and butterfly flowers of the Alps do not exist in Scotland. The reason is probably that it is in the highest degree unlikely that a Bombus would be foolish enough to fly over several miles of peat-moss to visit a little Alpine "island" on the chance of finding honey, hence no *Aquilegia alpina*, Linn., and few of the characteristic Leguminosæ and Gentians. This point must not be pushed too far. Most flowers have a most-favoured-nation clause for one

[1] Keane, *Ethnology*, 1896, p. 58. The discussion here of the glacial period is the best, or at least the most recent, known to me.

particular insect, but they do not deny commerce with other nations. No one who has seen the map and account of the range of Bombus and Aconitum in Drude's *Pflanzen Geographie*[1] can doubt that the range is, in some cases, influenced by the best possible insect visitor.

If we turn next to those plants which may be called the camp-followers of man or his domesticated animals or plants, we know that, whenever virgin soil is broken, a deadly struggle occurs between the domestic plant with its weedy clients and the natural vegetation. The seeds of Egyptian weeds have been found in the prehistoric lake villages of Italy. I have gathered, *e.g.*, in Tripoli, to quote my herbarium book, No. 3196, *Urtica membranacea*, Poir, "Aaron Arbib's orange gardens, rather sandy ground; sheltered. January 9th." This is an American weed brought with the oranges. A very interesting discussion of this point is to be found in the New Jersey Agricultural Experiment Station report.[2] Mr. Halsted shows there clearly how weeds of different origins have traversed the country: *Papaver dubium*, Linn., from Europe, travelling 25 miles in 15 years (*l.c.*, p. 321). The *Argemone mexicana*, Linn., has invaded the country from tropical America. *Abutilon Avicennæ*, Gaertn., has come from India and is working westward, whilst *Xanthium canadense*, Mill., and others are native plants which have become weeds of cultivation, just as our common plants did long ago.

I feel pretty certain that at least 100 dicotyledons of the "London Catalogue," and fully half the grasses, are either artificially introduced by man, or have been brought accidentally. This is about 12 per cent. of the flora, and probably a very long way under-estimated. For all these the limit is human agriculture, and, to a large extent, the skill in farming of a particular district.

Again, plants of fresh water are very widely distributed. This is probably through the fact of water birds carrying the seeds; the extremely wide range of ducks, *e.g.*, is notorious. It is conceivable that a fresh-water plant might pass right round the earth in four seasons if we take this into consideration. The

[1] Drude, *Pflanzen Geographie*, pp. 122 and 123. This is taken from Kronfeld, *Botan. Jahrbuch. für Systematik*, Bd. XI., p. 19.

[2] Annual Report, Botanical Department (New Jersey Agricultural Experiment Station), 1891.

limiting factors for fresh-water forms are, first of all, the existence of lochs or running water, and then the depths, character of the bottom, isothermal lines, and altitudes.

If we subtract all these groups from the British Flora, we have left the natural wild plants of the woods, Bramble clumps, Broom and Whin lands, river-sides, and so on. If we consider the changes the country has passed through, even in the historic period, the destruction of the Caledonian Forest, replanting, the introduction of Larch woods, the abandoning of Larch for other trees, the planting of sand-dunes and peat-mosses, and so on, it is obvious that it is, in the highest degree, rash to say that any species whatsoever is growing in its natural position. Still, there have probably always been uncultivated wooded spots in the country to which the Melica, Asperula, and Anemone could fly when any particular wood was cut down, and from which they could settle a new plantation.

Who could trace a species through these changes of place, even in one country? It is obvious that it must be the proper habitat and climate which limit their range, and nothing else.

It follows, I think, that we may in some cases distinguish indispensable conditions for the ranges of certain species. These are as follows:—

For halophytes—the existence of salt in the soil.

For chalk and limestone plants—geological boundaries, *i.e.*, the presence of lime in the soil.

For peat plants—the presence of peat.

For Alpine plants—mountains of sufficient altitude, with a series of appropriate habitats.

For weeds of agriculture—agriculture carried on in a manner which varies with each individual weed.

For forage plants and those consciously introduced by man—a certain intelligence in agriculture, varying in a similar manner.

For water plants—the presence of running or stagnant water, with the required depth and bottom, and also with appropriate temperature.

For road-side, waste, shale, ballast, and railway plants—a certain level of human civilisation, and also geological boundaries.

It follows, then, that no common dividing lines are to be expected, and that, in those cases at least which certainly make up 12 per cent., and may form 80 per cent., of the British Flora, river-valleys exercise no influence whatever. So far, I have simply been treating of the British Flora, but during my botanical journeys I have myself seen many dividing lines of the floras in a larger sense. In South Africa there are at least four; in West Africa there are two very distinct ones, the upland or Upper Niger Flora seen at Falaba, and the Coast Flora; in Egypt there are distinctly three; in Madagascar three; in Central Africa, from Mombassa to Uganda, and thence by Tanganyika to the Zambesi, seven different floras, more distinct in each case than the floras of Italy and Scotland.[1]

In every single case the dividing lines are indistinct; they remind one of the very excellent description by Mr. Miller Christy of the range of *Primula elatior*, Jacq., in Britain.[2]

The flora, as a whole, is defined by certain general climatic considerations, usually very obvious if one takes the amount and distribution in time of the rainfall, but in only one single case did I feel that the line could be drawn on the ground. That was in Egypt, where the boundary of the Nile overflow was clearly marked by the vegetation.

In all the other cases there is a debatable land; the rainfall is not the same every year, but varies yearly within pretty broad limits, and, no doubt, is also slowly changing over a series of years in one or the other direction.

Let me take two examples from my own experience—one well known, and one never, to my knowledge, published. Mr. Bolus has thoroughly described the Cape Flora.[3] The characteristic Cliffortias, Ericas, Proteas, &c., of the Cape Peninsula are not found in the Karoo, because the Karoo has no rain, and at a certain season the Cape Peninsula has. Yet there is a broad debatable land in which the two floras mingle, quite impossible to mark definitely, and with, I think, a few endemic species not found either in the Karoo or in the Cape Peninsula. The second

[1] I have not included special Alpine belts.

[2] *Journ. Linn. Soc.*, Vol. XXXIII., p. 172.

[3] *Handbook to the Cape Colony.* Also *Trans. and Proc. Bot. Soc. Edin.* Paper read November 14th, 1889.

example is from South-west Madagascar. There is a very distinct desert region here, beginning a little west of Fort Dauphin, in which the flora is totally different both from the highland Malagash plants and the tropical jungle plants of the eastern mountain slopes. I found a few of these desert forms, whose presence puzzled me until I discovered the existence of the barren, waterless country to the east, which I had neither time, money, nor health to explore.

Moreover, wherever any mountain raises its head above the low country, the climate, and therefore the plants, change completely. At the Cape, if one climbs the side of Table Mountain, there is a sudden definite and distinct change in the flora when one reaches the top, which is moistened by the refreshing mists of the Tablecloth. The droughty heathers and withered-looking little shrubs of the slopes give place to a profusion of beautiful orchids such as Disa, Irids of all kinds, tall and handsome composites, and so on.

On Ruvenzori the forest is followed by Bamboos, then Tree Heathers, finally reduced Alpine plants.

In the Pyrenees the Walnut trees in the valleys are followed by hardwoods, then come the fir woods, then Alpine meadows, finally the stunted Dryas and *Salix reticulata*, Linn., formation. The same sequence exists in Scotland.

The conclusion to which I have come is that all floras are in a state of migration, and this migration is by no means easy to trace. It is something like an army on the march into an enemy's country. There is a sort of reconnoitring cavalry screen, then a broad border of piquets, then an advanced guard, behind which follows the main body. Each of these is composed of different species adapted to the peculiar conditions in which they function.

For example, if the British plants are trying to occupy a sand-dune, Agropyrum begins on the barren sand exposed to the salt foam; then comes Psamma; in the ground occupied and *half* sheltered by Psamma comes Eryngium and the dune plants; then are found the wild grasses and sandy plants; and, finally, the main body of useful, if uninteresting, domesticated plants and their attendant weeds.

A similar series of fringes may be found round every loch, even on bare rocks or the sides of a heap of blaes.

It seems to me, therefore, that the boundaries of the larger floras, the limits of the petty invasions and skirmishings which we see in the flower-world round Glasgow, and the range of any particular species, are all very much of the same nature. They are very rarely definite: there is a border or debatable land. To study them properly, a purely artificial system is perhaps best. Any attempt to make geological boundaries applicable to, say, the Potamogetons or the Chenopodiums, would be absurd. The only convenient system generally applicable is, in fact, latitude and longitude, as has been, to my mind, most conclusively shown by Mr. C. B. Clarke.[1]

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[1] Biologic Regions, *Phil. Trans. Roy. Soc. London*, Vol. CLXXXIII. (1892), p. 371.

The Mosses of Campsie Glen: A contribution towards a List of Mosses of the West of Scotland.

By James Murray and R. D. Wilkie.

[Read 26th April, 1898.]

It has long been known to bryologists that Campsie Glen possessed a rich moss-flora, but it does not appear that any detailed list has hitherto been published. In the absence of such, it occurred to us that it would be interesting and useful to students in this department of Cryptogamic Botany, if a list could be prepared. Having this aim in view, we have, in company, made a number of visits to the Glen, and the following list gives the results of our observations. There are here enumerated 115 species and 2 varieties, belonging to 47 genera. Extensive as this list may seem for a lowland glen (the more especially when it is stated that the area investigated embraced that part of the Glen only from the entrance behind the hotel to where the burn is crossed by the road to Fintry, a distance of not more than a mile and a half, and when it is remembered that the Sphagnums are not included), still it is not pretended that it is exhaustive; on the contrary, we feel sure that a more careful search would be rewarded by the addition of a number of species.

Mosses of Campsie Glen.

Those in fruit marked *

*Andreæa petrophila, Ehrh.
*Catharinea undulata, Web. & Mohr.
*Polytrichum aloides, Hedw.
*urnigerum, Linn.
piliferum, Schreb.
juniperinum, Willd.
*Diphyscium foliosum, Mohr.
*Ceratodon purpureus, Brid.
*Rhabdoweisia denticulata, B. & S.
*Dichodontium pellucidum, Schp.
*flavescens, Lindb.

*Dicranella heteromalla, Schp.
*rufescens, Schp.
squarrosa, Schp.
*Blindia acuta, B. & S.
Dicranoweisia cirrata, Lindb.
Campylopus fragilis, B. & S.
Dicranum scoparium, Hedw.
majus, Turn.
*Fissidens bryoides, Hedw.
adiantoides, Hedw.
*taxifolius, Hedw.
*Grimmia apocarpa, Hedw.
*apocarpa, var. β rivularis, W. & M.
*pulvinata, Smith.
*Rhacomitrium aciculare, Brid.
fasciculare, Brid.
heterostichum, Brid.
lanuginosum, Brid.
*Ptychomitrium polyphyllum, Fürnr.
*Hedwigia ciliata, Ehrh.
*Tortula muralis, Hedw.
*subulata, Hedw.
*Barbula rubella, Mitt.
*tophacea, Mitt.
unguiculata, Hedw.
*Weisia microstoma, C.M.
*viridula, Hedw.
*rupestris, C.M.
Trichostomum tenuirostre, Lindb.
tortuosum, Dixon.
Zygodon Mougeotii, B. & S.
*viridissimus, Brown.
*Orthotrichum rivulare, Turn.
*rupestre, Schleich.
diaphanum, Schrad.
*Bartramia ithyphylla, Brid.
*pomiformis, Hedw.
Philonotis fontana, Brid.
Breutelia arcuata, Schp.
*Webera cruda, Schwgr.
nutans, Hedw.
annotina, Schwgr.
albicans, Schp.
*Plagiobryum Zierii, Lindb.
Bryum filiforme, Dicks.
*pseudo-triquetrum, Schwgr.
*cæspiticium, Linn.
*capillare, Linn.
alpinum, Huds.
argenteum, Linn.
Mnium rostratum, Schrad.
undulatum, Linn.
*hornum, Linn.
*serratum, Schrad.
stellare, Reich.
punctatum, Linn.
Fontinalis antipyretica, Linn.
*squamosa, Linn.
Neckera crispa, Hedw.
complanata, Hübn.
*Homalia trichomanoides, Brid.
Porotrichum alopecurum, Mitt.
*Anomodon viticulosus, Hook. & Tayl.
Heterocladium heteropterum, B. & S.
heteropterum, var. β fallax, Milde.
Thuidium tamariscinum, B. & S.
Climacium dendroides, W. & M.
Orthothecium intricatum, B. & S.
Isothecium myurum, Brid.
Pleuropus sericeus, Dixon.

*Brachythecium rutabulum, B. & S.
rivulare, B. & S.
*populeum, B. & S.
*plumosum, B. & S.
purum, Dixon.
Eurhynchium piliferum, B. & S.
prælongum, B. & S.
Swartzii, Hobkirk.
*Teesdalei, Schp.
myosuroides, Schp.
striatum, B. & S.
*rusciforme, Milde.
murale, Milde.
confertum, Milde.
Plagiothecium depressum, Dixon.
Borrerianum, Spruce.
denticulatum, B. & S.
*undulatum, B. & S.
Amblystegium serpens, B. & S.
fluviatile, B. & S.
filicinum, De Not.
Hypnum Sommerfeltii, Myr.
exannulatum, Gümb.
uncinatum, Hedw.
commutatum, Hedw.
falcatum, Brid.
*cupressiforme, Linn.
molluscum, Hedw.
palustre, Linn.
ochraceum, Turn.
cuspidatum, Linn.
Schreberi, Willd.
Hylocomium splendens, B. & S.
loreum, B. & S.
squarrosum, B. & S.
triquetrum, B. & S.

White Cattle: An Inquiry into their Origin and History.

By R. Hedger Wallace.

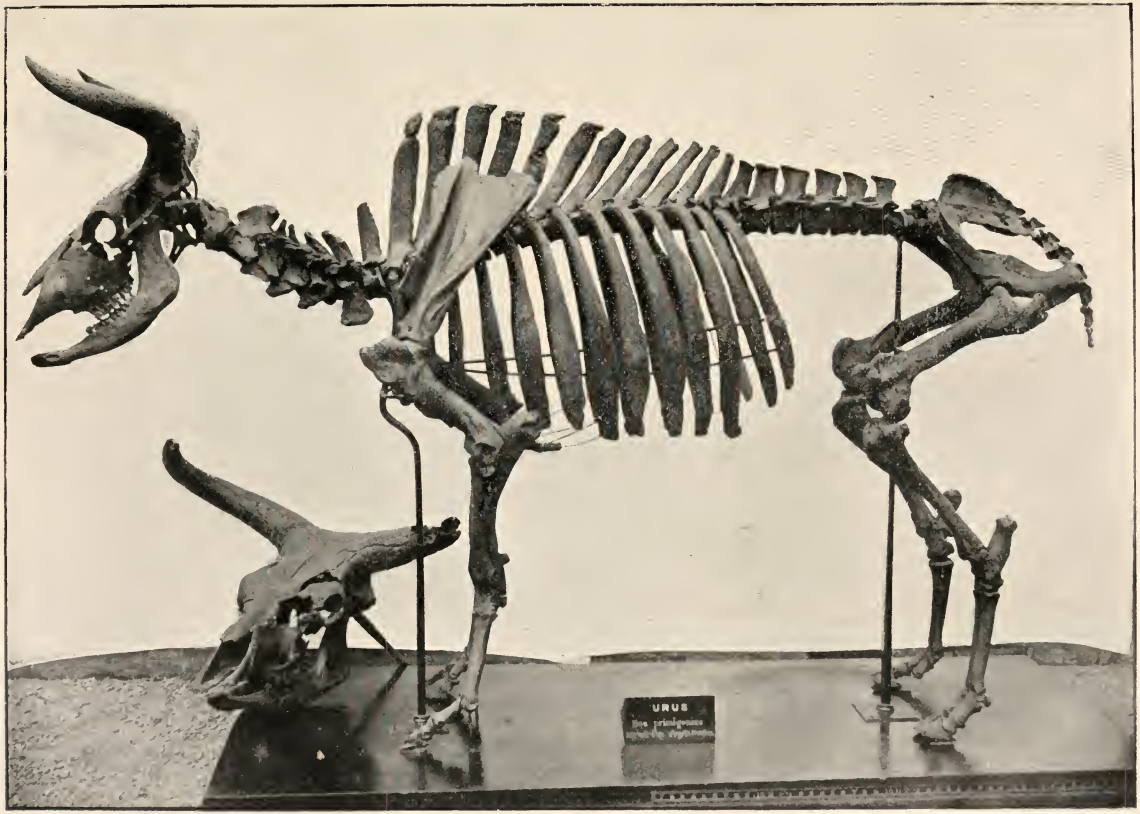
[Read 26th April, 1898.]

This subject naturally divides itself into two parts—first, the origin of the race or breed; and secondly, the history of the herds, past and present. I confine my attention in this paper to the origin of this breed.

Part Ia.

This is not the first occasion on which the subject of white and so-called wild cattle has been brought before the Society. Exactly ten years ago Mr. Robert Turner read a paper on "The Cadzow Herd of White Cattle" (*Transactions*, Vol. II., N.S., pp. 222-244), and previously, in 1880, Mr. Edward R. Alston also touched upon the subject in his article on "Mammalia" in *The Fauna of Scotland*, published under the auspices of this Society. The origin of our common herds of cattle is a question of interest to the agriculturist and naturalist, and it is from the point of view of its being a debatable question in agricultural natural history or zoology that I approach the subject.

I would first direct attention to the views expressed by Messrs. Alston and Turner in the papers already referred to. A commonly accepted view regarding white cattle is, that they are the true descendants, in an unbroken line, of the aboriginal cattle that existed in Britain in prehistoric times, commonly known as Urus, Forest Cattle, Park Cattle, Wild White Cattle, and distinctly as *Bos primigenius*, Bojanus [Pl. IV.]. Mr. Alston says, "to me the evidence appears overwhelmingly to prove that the modern Park Cattle are *not* wild survivors of the Urus, but are the descendants of a race which had escaped from domestication, and had lived a feral life until they were enclosed in the parks and chases of the



From Photograph by *Ralph Starr.*

SKELETON OF URUS (*Bos primigenius*, Bojanus) IN THE MUSEUM OF THE UNIVERSITY OF CAMBRIDGE.

mediæval magnates." Mr. Turner, in his paper, limits himself to the Cadzow Forest herd of white cattle. He says that "the popular exaggeration that they are a distinct and untamable race has grown out of the eagerness of human nature after the unique. A *Bos or Urus scoticus* would be a singularity of much patriotic significance." Of course, Scotchmen are pleased when they find, for example, Mr. E. L. Trousessart, in his article "Bœuf" in *La Grande Encyclopédie*, now in course of publication, giving, as an illustration of white cattle, the "crâne de Bœuf des parcs d'Ecosse." For my part, I rather doubt the reliability of French authorities, when I find that they state that these cattle—"Race blanche des forêts"—are preserved by the Duke of Sutherland in a park 480,000 hectares, or about 960,000 acres in extent.[1] Regarding the Cadzow cattle [Pl. V.], Mr. Turner writes, "what peculiarly wild habits are there? I see only frightened animals, maternal instinct, and human savagery. Beyond shyness and watchfulness, none of the habits of the cattle strikes me as in any way other than to be expected in animals not thoroughly domesticated." "As to the origin of these white cattle," he further says, "I hold from their habits that we are not warranted in concluding that they are truly wild animals. The tamest animals, if left to themselves, revert in a few generations to a wild state. The relapsed herds of cattle, originating in strayed domestic animals, present, in some countries, a case in point, and in wild instincts and habits far out-do our British white cattle." Mr. Turner concludes his paper as follows:—"I think, however, that it may be taken as established that these white cattle have been about Cadzow from very remote times with an occasional break and reintroduction; that they are a fancy breed artificially preserved in a half-wild state; that they are descendants of a formerly domesticated race;

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[1] Another French writer, Professor Sanson, in the article "Ecossaise (Zootechnie)" in Barral's *Dictionnaire d'Agriculture*, states that we have three varieties of cattle. First, the "West Highland;" secondly, the "Kiloe;" and then "La troisième, qui vit dans le parc de Shilligham, au duc de Sutherland, pour en faire seulement l'ornement comme objet de curiosité aristocratique, est ce qu'on appelle en Angleterre la *race blanche des forêts*. Un spécimen empaillé est exposé au British Museum de Londres. Il n'y a pas lieu de s'en occuper autrement que pour la signaler ici, son utilité zootechnique étant nulle."

that there have been from time to time infusions of fresh blood into the herd, and that their so-called wild habits are mainly the result of their treatment for centuries."

Such, then, are the conclusions that have already been placed before the Society. With the Cadzow herd I shall deal later, when inquiring into the history of various herds of white cattle in Britain. I may here say that Martin, writing in 1852 about "the semi-wild cattle of Chatelherault Park, Lancashire [*sic*], belonging to the Duke of Hamilton," says, "these feral cattle are larger and more robust than the Chillingham . . . The cows, and also the bulls, are generally polled or hornless." Thus, 50 years ago, these cattle were regarded as feral. Personally, I hold the same opinion of these white cattle as Messrs. Alston and Turner; but I go a step further, and I think I will be able to show that these cattle are simply the descendants of Roman cattle imported into the country during the Roman occupation. This is the view held by Professor Hughes, the Woodwardian Professor of Geology at Cambridge (Journ. Roy. Agric. Soc. England, 1894, Vol. V., 3rd Series, Pt. III. — Archæologia, 1894-5, Vol. LV., pp. 125-158), and Mr. Lydekker, the well-known authority on Mammalia. I consider that we can even trace their origin to one or two sources. They come either from white cattle imported for sacrificial purposes, which, being scarce, were much prized and carefully protected (they would be the "clean oxen," or oxen chosen for sacrifice, which often had to be entirely free from black spots or even a single black hair); or from collections of white calves, which, being dropped by dark-coloured cattle, were regarded in the Roman period as a portent of good to the individual or state, as the case might be, and were therefore looked upon as of much value and preserved. They may come simply from the large whitish domestic cattle, common in the Roman period, and preserved in Britain simply because they were large. This large white breed even now exists in Italy, Hungary, and Roumania, and such an animal, when compared with the indigenous cattle, as represented by the Kerry cattle for example, would no doubt appeal to the business instincts of our cattle-breeding forefathers.

While placing these points before the Society, I cannot lay claim to originality. Many of them were advanced over fifty years

From Photograph by *George Cleland.*

WHITE BULL—CADZOW HERD.

ago. A writer, for example, in the *Penny Magazine*, in 1838, on our wild cattle, says:—"It is, however, highly probable that these animals are the remains of a breed which was formerly kept tame in the farms in many parts of England." Another writer on "Animal Economy," in the *Farmers' Library* (1847), says:—"The ancient Britons had tame cattle in abundance, and among these a white breed particularly valued. . . . The descendants of these might at various times have become feral . . . and of these feral herds the Chillingham wild cattle may be the lineal descendants, if not, indeed, the tame race once so much esteemed." Again, in the *Quarterly Journal of Agriculture* for 1829, James Wilson writes:—"The supposed original of this animal (the Urus of the ancients) is probably extinct in the living state. In the fossil skulls, which appear to represent it, the horns are curved forwards and downwards, but in the countless varieties of the domestic breed these parts are very different in their forms and direction, and are sometimes wanting altogether."

The early history of our cattle generally, or of white cattle specially, seems to rest on two descriptions—first, that of Cæsar, with his great long-horned, wild, and untamable Aurochs, or Uri, of the Hercynian, or Black Forest of Germany; and secondly, that of Hector Boece or Boethius, with his wild and untamable bulls of the purest white, having manes like lions, which roamed in the Caledonian forest. English and Continental naturalists have never been tired apparently of ringing the changes on these two descriptions. It is now generally admitted that Cæsar in his description has mixed up two animals. He tells us that "great is their strength and great their speed," that they have the appearance, colour, and form of an Italian bull, though as large as an elephant, and that so savage is their nature that, "though taken never so young, they cannot be tamed," while "those who kill most bulls carry back the horns as a glorious trophy of the chase." If Cæsar's Urus be regarded as a Bison, then it could not have had the appearance, colour, or form of an Italian bull. If it be regarded simply as an Ox, then it could not have had the antipathy to the other Bovidæ we are told that it did show. Did Cæsar ever see these animals? Seeing that modern scholarship states that Cæsar's Commentaries, &c., especially regarding the Hercynian Forest, are simply transcripts from Pytheas, who

made the journey to Britain, and these regions, and lived about the middle of the fourth century before Christ, I myself think it doubtful, or he would not have mixed up two animals, or have transcribed the description of them from Pytheas. As regards Boethius, it is strange that credence was given to his description of lion-like bulls. He tells us in his "History," which contains the account of the lion-like bulls, that "in the year of God 1510 a very strange animal came out of Gairloch, in Argyle, as 'meikel as ane grewhound,' with feet like 'ganer,' and that great trees were struck down by 'dint of her tail.' She killed three men (hunters) with 'three strakes of her tail,' and that if the 'remaunt hunters' had not 'clam up in a strang aikis' they would have been 'all slain in same manner.'" If the story of the lion-like bulls is accepted, why is that of the feminine grewhound rejected?[1]

Anyway, in the passage about wild lion-like bulls, Hector Boece himself says that the wild white cattle are exceedingly like the ordinary tame or domestic breed, and that their flesh is very pleasant food, and much approved of by the nobility. Here, I think, we find one reason why these white cattle have been preserved, namely, that their flesh was much approved of by the nobility in olden days. Many illustrations can be given in support of this point. As it is often claimed that Cadzow Forest is a part of Boece's Caledonian Forest, and the white cattle there the descendants of his lion-like bulls, I would direct attention to a report in the *Glasgow Herald* of a paper by Mr. Hugh Boyd Watt, on "Scottish Forests as they appear in early historic times," read before the Andersonian Naturalists' Society. Mr. Watt, in his paper, pointed out that (so far as the word "forest" is to be taken as meaning a piece of woodland or a tree-clad district, and not a chase or hunting ground lying in waste) it seems clear that our native forests had passed their maximum size and density at the dawn of history in Scotland. Evidence in support of this is chiefly furnished by the widespread distribution of our peat bogs and mosses, in which many remains of forest trees, mostly oaks and birch, are to be

[1] Gesner gives an illustration which appears to be that of an ordinary greyhound, and writes "Canis Scoticus Venaticus, quem Scoti vocant *ane grewhound*, id est canem Græcum."

found. By the time of the Roman invasion a certain extent of clearing must have been effected by the natives, who mustered in considerable numbers, sometimes fighting in chariots, and who possessed horses and herds of cattle, for which pasture land was necessary. The Romans effected further clearances, largely of a destructive character; but their historians, who furnish us with the earliest written contributions towards our history, give but little definite information as to the forests of Scotland, although incidental mention of woods is not wanting, such as occur in passages in Tacitus's "Life of Agricola." They distinguish a particular portion of the country as "Sylva Caledonia" (Pliny iv. 30) or "Caledonias Silva" (Ptolemy), the Caledonian Forest, probably because it was the densest woodland they knew in Scotland. This seems to have extended on the south from about the heads of Loch Long and Loch Lomond by the line of the Forth to Stirling, stretching northwards of this line as far as Dunkeld. Mr. Watt pointed out that modern, and particularly recent, writers have extended the limits of this great wood, until by their license it is said to have covered the whole of the Scottish mainland south of Sutherland. This he held to be unhistorical and misleading, however fine it might be from a sentimental point of view. For instance, in his opinion, to say, as is frequently done, that the fine old oaks at Cadzow originally were part of the Caledonian Forest is an error, as Cadzow is outwith the bounds of the original forest; and the loose way of speaking of many old pieces of woodland as "remains of the ancient Caledonian Forest" is just as inaccurate. "Sylva Caledonia" seems to have been only a definite district, and the names of the woods which occurred elsewhere in these early times have not come down to us.[1]

It is also stated that the skulls of the white cattle show that they are degenerate descendants of the *Bos primigenius* found in Pleistocene deposits. There seems to be only one solitary authority for this statement, namely, Professor Rütimeyer, of Basle,

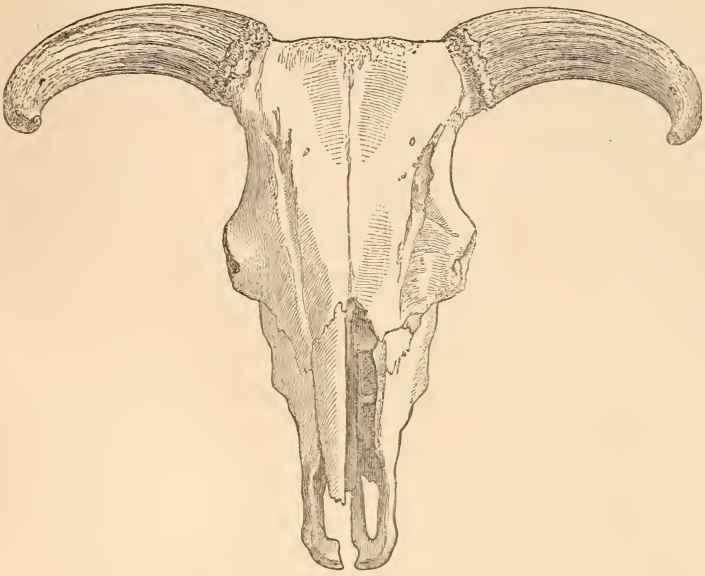
[1] "In most cases in which *forest* was used with reference to these cattle, it meant little more than the *fell* does to a Cumberland farmer, *i.e.*, the open ground beyond the fields, where sheep and beasts roam about, at any rate during Summer." Professor T. M'Kenny Hughes, *in lit.*, 26th November, 1898.

in his "Domestic Cattle of the Ancients," and he is universally quoted by naturalists in support of this contention. Professor Rütimeyer, I find, said such was his opinion of only one of our herds of white cattle, namely, that at Chillingham Park (Fig. 1), but, at the same time, he added that the fineness of the Chillingham bone is not characteristic of a real wild race. On this point we may quote Vasey, who, in his monograph on the ox, says the "Chillingham cattle are white and the Highland

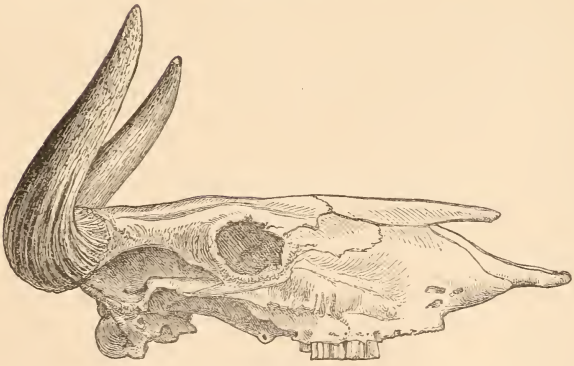
Fig. 1.—Head of the Chillingham Bull shot by H.R.H. Prince of Wales (1872). (*Storer*, p. 169.)

cattle or Kyloes black, but, with this exception, the very same description might serve for both breeds." Martin, who wrote in 1852, also says—"Change the colour from black to white, and there is little difference between the Kyloe from Arran, Islay, or Isle of Skye, and one of the wild cattle of Chillingham." Of course it is admitted that the cranium will be less liable to modification than any of the other bones in the skeleton, and that, even if the bones are not characteristic, still vestiges of the original

type can be looked for in the head. But, taking the head and the set of the horn cores thereon, it has been shown by Professor



FRONT VIEW.



SIDE VIEW.

FIGS. 2, 3.—Skull of *Bos primigenius* found in Fifeshire ($27\frac{3}{4}$ inches in length).

Hughes that none of our wild cattle can claim descent from *Bos primigenius* (Figs. 2, 3). On examining Professor Rütimeyer's

plates of the skulls of fossil and existing types of oxen, I cannot accept his typical skull of the fossil *Bos primigenius* as at all typical, and his typical skull of the existing type of *Bos primigenius* is undoubtedly more closely related both to the existing and fossil types of Owen's *Bos longifrons* than to anything else.

The common idea is that our white cattle is a primeval indigenous breed, which lived isolated and preserved in ancient impenetrable forests. Consequently Sturtevant writes that "a continuous range of enormous forests covered the whole extent of the country, while the gigantic and fierce cattle roamed through the chase." Unfortunately for common tradition, cattle could not exist in dense forests, as their habitat and feeding-place is in open plains, and they seek wood only for shelter. So that the various herds of white cattle that have been preserved did not originate in a portion of a great forest being enclosed, and these cattle being made prisoners within the enclosure. Besides, we have ample evidence and proof that in early and mediæval times, when all land was unenclosed, and herds roamed half wild over the country, the prevailing colour was black and red, and not white. Runaway cattle from these herds would naturally seek forests and woodlands to hide in, and there easily revert to feral conditions. But this does not necessarily imply they would become white; in fact, Darwin in his work, *Animals and Plants under Domestication*, says that the Spanish and other cattle "which have run wild on the Pampas, in Texas, and in two parts of Africa, have become of a nearly-uniform dark brownish-red." Many say that the colour of aboriginal cattle was white or yellow, and that domesticated cattle in a feral condition revert to this colour, quoting Darwin's remarks on the cattle of the Falkland Islands in support of their theory. This theory has also been advanced as a proof that our white cattle are the original and indigenous cattle of Britain. But what Darwin actually says in his *Voyage of the Beagle* regarding the Falkland Island cattle is that "in colour they differ much; and it is a remarkable circumstance that in different parts of this one small island different colours predominate. Round Mount Usborne, at a height of from 1,000 to 1,500 feet above the sea, about half of some of the herds are mouse or lead coloured, a tint which is not common in the other parts of the island. Near Port Pleasant, dark brown prevails, whereas south

of Choiseul Sound (which almost divides the island into two parts) white beasts with black heads and feet are the most common. In all parts, black and some spotted animals may be observed . . . It is thus," he adds, "interesting to find the once-domesticated cattle breaking into three colours." This, of course, indicates the prepotency of three separate ancestral types.[1]

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[1] As regards the question of colour, a writer in the *Quarterly Review* for 1869, says—"But we know that colour is the most variable of all an animal's characters, and yet in a state of nature colour as a rule is very constant in each species. Mr. Darwin has shown, however, that colour is often intimately associated with other constitutional peculiarities. In Virginia the paint root (*Lachnanthes tinctoria*) is eaten by pigs, and makes their hoofs drop off. But black pigs are uninjured by it. Consequently, in places where this plant is abundant the farmers never keep any but black pigs, as no others can be raised except in confinement. Here we have a beautiful illustration of the mode of action of 'natural selection.' The pigs of Virginia are not all born black any more than in other countries, but those of all other colours soon die, and therefore in a state of nature a black race would be produced; and from the powerful action of the law of hereditary descent there can be little doubt that in time the litters would consist almost entirely of black pigs. If after this had happened it were first discovered that white or brown pigs could not live in the district, we should have a striking example of adaptation; but the adaptation would evidently be an adjustment brought about by the simple law of 'natural selection' or 'survival of the fittest,' and the rigid extermination of all individuals not adapted to the surrounding conditions. It can be easily seen that in this case 'natural selection' does not imply a personal selector, since exactly the same result must happen whether the farmer kills off the white pigs himself and turns the black ones loose, or turns out all together. This case, although curious, is by no means isolated. White terriers suffer most from distemper, and white chickens from the gapes. In Sicily the *Hypericum crispum* is poisonous to white sheep alone. White horses suffer severely from eating honey-dewed vetches, while chestnuts and bays are uninjured. Purple plums in North America are subject to a disease from which green and yellow plums are free. Again, the white pigeons of a flock are the first to fall victims to the kite. White rabbits of a very hardy kind have been turned loose but fail to maintain themselves, and black fowls on the west coast of Ireland are picked off by sea-eagles. Here we have the explanation of the otherwise puzzling fact, that white quadrupeds and birds are so rare in nature, although abundant among all domesticated animals; and the explanation is all the more satisfactory because it accounts for the exception to the rule in the case of many arctic birds and quadrupeds as well as of sea birds, for to these the white colour is a protection instead of a danger."

We often lose sight of the social conditions of life in past days in discussing the history of our cattle breeds. The country was unenclosed, and cattle was the medium by which penalties were paid and gifts made. Cattle were also raided and lifted as opportunity occurred. In fact, from Anglo-Saxon laws we learn that special care was taken in regard to certain goods where the presumption of theft was particularly strong, such goods being cattle and old clothes. Now, under the conditions of raiding, gift-giving, and penalty-paying, cattle must have been easily transported, and be regarded rather as tame than wild beasts. In mediæval stories of the Bubali or Tauri sylvestres (Fig. 4), we read of

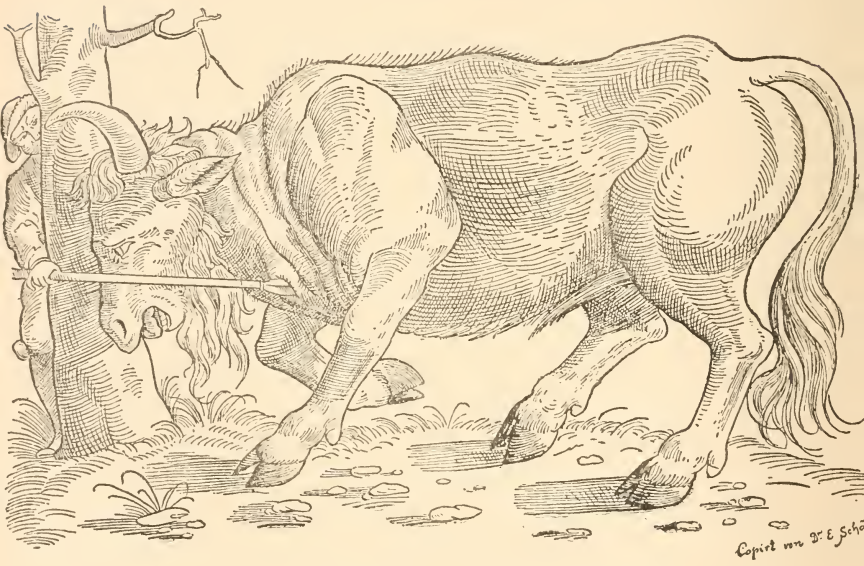

FIG. 4.—Hunting the Urus.

them as wild beasts. Bubalus would be used for cattle that had escaped, *i.e.*, run wild. *Bos camporum, bubalus nemorum.* Were the "bubali" cattle in our sense of the word? This is a point I will discuss further on in my paper. But "wild beasts" is a common expression for cattle under certain conditions. We say that cattle on ranches are wild because they roam, feed, and breed uncontrolled; but they are still domesticated cattle, and not un-

reclaimed aboriginal beasts. I think my view of the term wild can be upheld. In the "Foure Bookes of Husbandry," written by Googe in 1577, he says in his second book, "Entreatying of the ordring of wooddes," that "some of them be wylde and grow of themselves, not needing any looking to." Taking "wylde" in this sense, would it not be exact to say that our "wild cattle" are the descendants of a "white domesticated race turned loose to a life of comparative freedom." I shall refer to the subject again when I come to deal with the historical data I have been able to glean.[1]

Another factor we must bear in mind is that, in the days of open pasture, bulls were roaming about, and herds' books were unknown, so that purity of breed is an absolute impossibility, yet we know that the Devons have kept all red, the Pembrokes all black, and the park cattle white, which shows the prepotency of their ancestral types. Further, the "wild" park cattle have certain indications which show that they are not from a wild race, but from an ancient domesticated breed—

1*st.* They are of the same species as domestic cattle, and breed readily with them.

2*nd.* They go with their young precisely the same time.

3*rd.* Their bones are fine, while those of the Urus, their supposed ancestor, are coarser even than those of the Bison.

4*th.* They calve at all seasons.

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[1] The word "wild" seems to have been used in many senses. More, in his "Utopia," writes—"Your sheep that were wont to be so meek and tame, and so small eaters, now, as I hear say, be become so great devourers and so wild that they eat up and swallow down the very men themselves." Again, Spenser says:—

> "I saw a Bull as white as driven snowe
> With gilden hornes embowed like the moone."

And on another occasion he writes:—

> "Like a wylde bull, that, being at a bay
> Is bayted of a mastiffe, and a hound."

It will be noticed that he does not say that the white bull was wild, and his "wylde bull" is simply a savage animal. The bulls at bull-fights are not wild in the sense we speak of wild animals. Further, we read of "wild field-grass husbandry" as a more primitive form of agriculture than that practised by village communities. Here "wild" cannot be uncultivated.

5th. Vasey has pointed out that, in not being in heat at any particular time, they differ from every known wild species of cattle, among which the rutting season invariably occurs at a particular period of the year. Herberstein states that the Thur or Urus produces its young in spring, and that such as happened to be born in autumn rarely survived. Instead of being wild, the difficulty in the case of the white park cattle is not so much to tame them as to keep them wild.

At this point I would direct attention to three descriptive labels placed in the galleries of the British Museum of Natural History, two in the Geological Department and one in the Zoological.

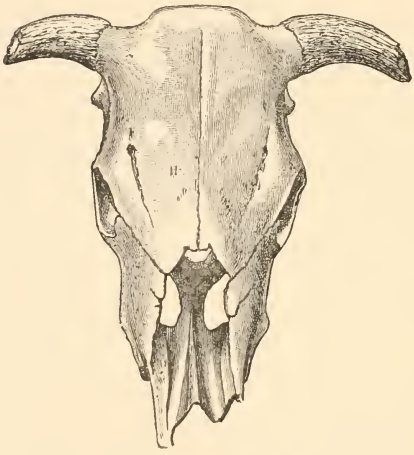

Fig. 5.—*Bos longifrons*, Burwell Fen, Cambridge. Woodwardian Museum.

The first, headed "Gigantic Aboriginal Wild Oxen of Britain," says, "although they surpassed in size, and in the greater expanse and strength of their horns, any of our modern breeds of cattle, they were, in all probability, the ancestors of the larger existing cattle of Western Europe. The wild cattle preserved in Chillingham Park, Northumberland, may perhaps be the last surviving descendants of *Bos primigenius* of the Pleistocene period, very considerably reduced in size, and modified in every respect by their diminished range and contact with man." This is the orthodox view very cautiously stated.

The second label in the Geological Department deals with "Celtic Shorthorns," and says:— "The small Celtic Shorthorn breed of cattle, once so characteristic of the whole of the British Islands. This is the *Bos longifrons* of Owen [Fig. 5]. Some of the skulls are of the hornless variety. *Bos longifrons* was probably the ancestor of the small breeds of Welsh and Scotch

Shorthorn and hornless cattle domesticated by the aborigines of Britain before the Roman invasion. Had the *Bos primigenius* been the source, we might have expected the Highland and Welsh cattle to have retained some of the characteristics of their great progenitors, and to have been distinguished from other domestic breeds by their superior size and the length of their horns. The Kyloes and the Runts are, on the contrary, remarkable for their small size, and are characterised either by their short horns, as in the *Bos longifrons*, or by the entire absence of these weapons."

The third label, headed "The Typical Oxen—*Bos Taurus*," is in the Zoological Galleries, and was written by Mr. Lydekker. It says:—"The Aurochs, or Urus, the old wild ox of Europe, is now completely extinct as a wild species, although all the European domestic breeds may be regarded as its more or less modified descendants. . . . The half-wild white cattle of Chillingham and some other British Parks have been regarded as the direct descendants of the Aurochs, but it is more probable that they are derived from domesticated animals, possibly from the Italian breed introduced by the Romans into Britain."

It will be noticed that this differs somewhat from the first label mentioned as in the Geological Galleries, and the matter is put cautiously also, as a mere conjecture. Mr. Lydekker informs me that the authority for the suggestion that the Chillingham cattle were introduced from Italy is Professor T. M'Kenny Hughes, of Cambridge, whose name I have already mentioned.

Whether we think these cattle true descendants of the Urus, or simply descendants of a Roman breed, it is too true, as Sir Wm. Flower writes me, that "there is, unfortunately, no authority for any statement about the origin of the white park cattle of England." Such evidence as can be offered is what can be accepted simply on the grounds of it being reasonable and appealing to our common sense, with the addition, in the case of the Roman cattle theory of the origin of park cattle, of allowing comparisons being made with the skulls and horns of ancient and modern Italian breeds, ancient Celtic Shorthorns in Britain, Romano-British cattle, and mediæval and modern cattle, in support of statements made in support of the theory.

On this point I may say that, finding in a recently published

work—"Wild Traits in Tame Animals," by Dr. Louis Robinson—the statement that the "wild white cattle" are direct descendants of the Urus or *Bos primigenius*, I took the liberty of asking the author what proof he had that such was the case. I now take the further liberty of quoting some parts of his exceedingly courteous and interesting reply :—

Dr. Robinson says—"I am afraid I can only refer you to the statements made by Darwin, Nilsson, Rütimeyer, and Boyd Dawkins. Your conjecture interests me very much, especially as I have long had doubts as to whether 'wild' white cattle of Chillingham and elsewhere are the descendants of any truly wild breed. One scarcely ever finds wild animals outside the Arctic Zone of a white colour, and I think it is extremely probable that human selection long ages ago accounts for their colour. You will find some very interesting notes on the subject in Darwin's 'Animals and Plants under Domestication,' page 84. After reading a great deal of the literature published on the subject, I have come to the conclusion that practically all the views put forward as to the descent of various strains of modern cattle from this and that wild ancestor are not much more than guesses. I think we may be fairly sure of this, that in a country as settled and civilised as Britain was at the time of the Roman invasion there were few, if any, truly wild cattle. One finds that in all parts of the world where men have horses—and also among the savages of South Africa—the cattle have been brought under human control. This seems rather to support your view that the cattle of Chillingham are feral and not truly wild."

Our common cattle, *Bos taurus*, is no doubt a mixed product of extremely numerous and very diverse factors, developed in widely separated regions. This animal when wild was probably hunted by man, but, tamed, it has accompanied him in all his wanderings. Its geological history in Britain, according to Owen, is first a large species of ox, *Bos antiquus*, followed by a somewhat smaller but still stupendous wild ox, *Bos primigenius*, succeeded in turn by an aboriginal British ox of much smaller stature with short horns. *Bos longifrons*. This, says Owen, was probably the source of the domesticated cattle of the Celtic race before the Roman invasion. Cæsar tells us that Britain was well peopled, and that they possessed numerous large herds of domesticated

cattle; and British rubbish-heaps that have been explored show only one variety, *Bos longifrons*, thus confirming Professor Owen's statement.

Professor Wilckens, of Vienna, taking Professor Rütimeyer's three forms, *i.e.*, *Bos primigenius*, *Bos taurus frontosus*, and *Bos taurus brachyceros* (the peat cow), adds to it *Bos taurus brachycephalus*. Representatives of this form, he says, are the breed of Alpine cattle in the Eastern Tyrol, in Duxerthal, and the Zellerthal, and the closely allied Enngerthal cattle of the Canton Vaud. These, he considers, descend not from the Urus, but from the Bison. Werner and Weissenhorn either make no mention of this form, or do not accept it, on the grounds of the natural antipathy that the Bison shows to *Bos taurus*, and that all such artificially procured mixed breeds have failed. This probably applies to the European Bison. The American Bison has been crossed with the domestic cow and the wild oxen of India, and the hybrids have proved fertile. But this has been accomplished when domesticated. Anyway the Bison can have nothing to do with our breeds. Bison bones in Britain are found only in the older gravel terraces of the rivers which ran at a higher level than now, while the bones of the Bos are found in fens and modern alluvial deposits.[1] The Bison and Bos may have had a common ancestral form. Professor Rütimeyer is of opinion that the genus Bubalus, as represented by the early forms of Indian oxen from the older Pliocene deposits of the Sewalick Hills, may have been probably the ancestral stock from which the later types of Bison and Bos originated. Professor Wilckens himself, writing on the ancestors of the Bovidæ and fossil Bovidæ, considers their earliest form to be Gelocus in the Eocene period, first described by Kowalevsky.

Most German authorities now regard the tame breeds of the lowlands bordering on the North Sea and the Baltic, the breeds of Friesland, Holland, Holstein, and Podolia, as modified descendants of the Urus. The heavy spotted breeds of Central Europe, the spotted cattle of French, Swiss, South German, and Scandinavian races, with rudimentary horns or minus horns, as coming from the quaternary ox, *Bos frontosus*; and to *Bos*

[1] Some of our authorities state that the fossil remains of *Bos primigenius* are found only in British palæolithic deposits, but not in neolithic.

brachyurus is attributed the uniformly coloured and unspotted races, with short strong horns, such as the Highland, Brittany, Auvergne, and Schwyz breeds. Professor Boyd Dawkins, writing on this point, says, "the *Bos longifrons*, which, in our opinion, will ultimately be found to be specifically identical with *Bos taurus*, was the variety that supplied Roman legionaries in Britain with beef. Whether or not the great Urus and the small Shorthorn (*Bos longifrons*) be extinct or live—the one in the large domestic cattle of Europe, as the Flemish oxen and those of Holstein and Friesland, the other in the smaller breeds—has not yet been satisfactorily decided."

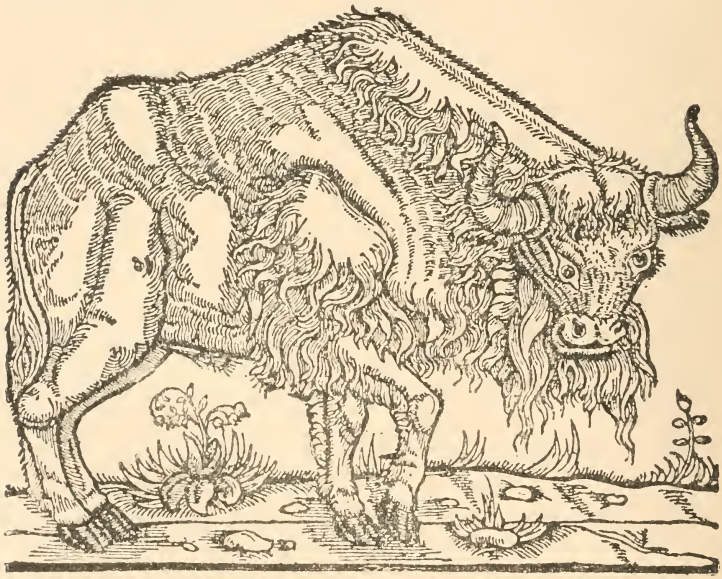

Fig. 6.—The Bison (after *Gesner*, 1551).

We have seen that *Bos longifrons* was the only variety in pre-Roman remains, and the middens of Roman camps show us that it is the only ox used by the Romans generally. According to the "Edinburgh Review," *Bos longifrons* was the principal food in France, Germany, Britain, and Italy throughout the Bronze and Iron Ages. *Bos longifrons* may have developed from *Bos primigenius*, but this leads to idle speculation. Anyway it has

not yet been proved to have existed alongside with these extinct Pleistocene mammalia. We may say, so far, that, of the genus Bos, the species *Bos primigenius* existed in the Pleistocene, the species represented by the Urus of Cæsar and the Celtic Shorthorn of Owen existed in the prehistoric period, and species of taurus from one or both of these may now be living. Our latest authority on the Bovidæ—Middendorff—says that there are two chief races of European oxen, both of which are varieties of *Bos taurus*, viz., (1) a lowland race (*Bos taurus primigenius*), to which belong the cattle of Western Europe, Russia, and the Steppes, as well as

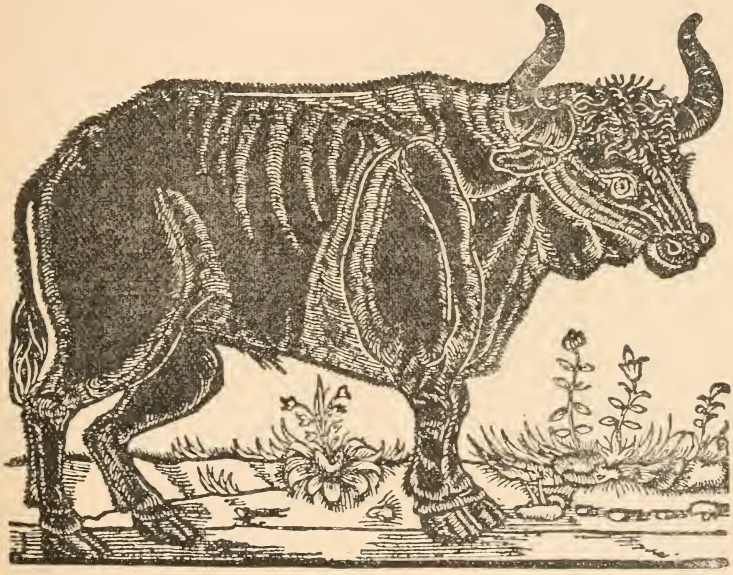

Fig. 7.—The Urus (after *Gesner*, 1551).

those of the primitive forest regions; (2) a highland race (*Bos taurus brachyceros*), which has given origin to the cattle of Southern Europe and probably of North Africa. In Britain we are only concerned with *Bos primigenius* and *Bos longifrons*. The Bison is found with us in river gravels. This species apparently lasted through the time when man used rough unpolished stone implements, but has not been found in Britain with the remains of the men of the Polished Stone Age. The

Fig. 8.—Hunting the Urus in 1596 (*Sämacher*).

periods in prehistoric times being—(1) Flint; (2) Rude, Unpolished Stone; (3) Polished Stone; (4) Bronze; (5) Iron.

The Urus or *Bos primigenius* is first found in Britain with the Bison in the ancient river terraces. It lived on and became abundant, probably after the Bison had become extinct, throughout the age of Neolithic Man. But there is no record of its remains having been found in Britain associated with Roman objects, or anything that would show that it lived on later than the Bronze Age. As regards the Bison and Urus, Pliny distinguishes the two as Bonassus, with its thick mane—"maned with a collar like a lion"—and Urus with its terrible horns. Tacitus tells us that a tribute of Urus hides was imposed on the Frisians. This, I think, again mixes up the Bison with the Urus. I have come across a passage which I cannot definitely recall, which states that Urus hides were good to lie on, and I surmise that skins taken for tribute were so utilised, and for this purpose Bison hides would be desired—what we now call "Buffalo hides"—and not Urus hides, which are said to have been "hard." The Bison is the *Wisent* (Fig. 6) of the Germans and *Subr* of the Poles, while Urus (*Bos primigenius*) (Fig. 7) is termed Ur, Aur, Auerochs, by the Germans, and Tur or Thur by the Poles.

Specimens of the Urus were still found in the middle ages in Central Europe, the last known example of it having been killed in 1627 in the Zoological Garden of Count Samoisky, at Saklorowa in Poland. The slaughter of four Urus is mentioned in the *Nibelungen Lied* of the 12th century as having taken place in the neighbourhood of Worms. In the 11th century, the Elk and Urus were met with in Germany by crusaders *en route*. In the 10th century we find that the monks of St. Galle, in Switzerland, returned thanks to God for its flesh, while in the 9th century it was hunted (Fig. 9) by Charlemagne in the forest lands

Fig. 9.—Hunting the Urus. From *Globus*.

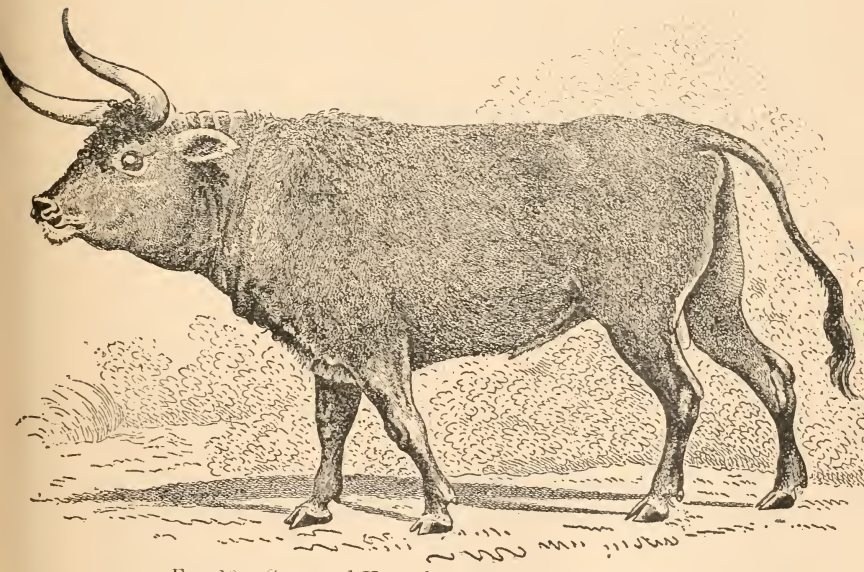

Fig. 10.—Supposed Urus, from an old Augsburg painting.

near Aix-la-Chapelle. The writer of the section on "Oxen," in "The Royal Natural History," states that "old chronicles

also prove that in the middle of the sixth century these animals were found, although rarely, in the province of Maine; while there is evidence that some of them at least were white in colour." These statements, especially the last as regards colour, I have been unable to verify. According to contemporary accounts, Urus (Fig. 10) differed from tame cattle only in being black, and having a whitish stripe on the back. In length, 11 to 12 feet, the height at the shoulders was about 6½ feet.[1] Compare this animal with what has been called its degenerate descendant. The purely park life—*i.e.*, the small and restricted enclosure we call a park—of the latter can only have been for a few centuries, and yet it has sadly degenerated, if it is possible to degenerate so rapidly. Granting that the appearance of black calves indicates an ancestor such as the Urus, which we know to have been black, in our white park cattle, then the prevailing white colour must indicate a period of domestication and breeding by selection, so that they cannot possibly be wild. But the horns

Fig. 11.—Form of horn after the Gisburne Cross.
From the *Zoologist*, March, 1891.

Fig. 12.—Form of horn before the Gisburne Cross in 1859.
From the *Zoologist*, March, 1891.

[1] Herberstein writes, that "Masovia, which borders on Lithuania, is the only province which has in it the kind of buffalo which, in the language of the country, is called *thier*, but which we Germans may, with propriety, call *urox*. They are a sort of wild oxen, not unlike tame oxen, except that they are entirely black, with a line down the back having white blended with it. They are not very plentiful, and there are certain districts which are charged with the care of them; and it is only in some few preserves that they are kept."

of the white park cattle show that the Urus (*Bos primigenius*) could not have been their ancestor. First, because the horns of our white herds are not all the same; those of the Chartley herd, for example, differ very materially from those of the Chillingham. Again, the Urus horns are very long and curved, first forward and downwards, and only upturned at the end. They curved forward in the plane of the animal's back. The horns of our white cattle are, like those of Roman oxen, ancient and modern, upright and upturned, lying approximately in the plane of the occipital region—sometimes called mooney or lyre shaped.[1] The two patterns of horns are shown if we hold a pitchfork, first horizontally, as if lying on an animal's back—the Urus type—and then vertically, as if at the side of the head—the white park cattle type. The Urus may have affected some of our other breeds of cattle, other than the white park cattle, and then only at second hand, through importations of long-horned German cattle. The larger breeds of cattle begin to appear, in many cases, from the Saxon invasion, most probably because the Saxons imported oxen from their old homes between the mouth of the Rhine and Jutland. Some of our domestic cattle have shown the Urus type. For instance, Dickenson, writing in 1852 on the "Farming of Cumberland," says:—"Within living memory the cattle in Bewcastle, Stapleton, Kirkandrews, Alston, and the neighbouring parishes were of the long-horned breed, and chiefly of dark colours, such as blacks, browns, and dark reds (the last colour most prevalent), with the distinctive white backs." Here we have the Urus markings—long horns, dark colour, and white back; but I do not know if any one claimed them to be indigenous descendants of the *Bos primigenius*. Now, in Sand-

[1] The Chartley cattle, which are said to have been enclosed 650 years ago from the Forest of Needwood, are essentially Longhorns, and have a very distinct dewlap. A writer in the *Field* says—"The Chartley type of head varies much from that at Chillingham, and shows a tendency towards the old breed from which Bakewell developed his Longhorns. The Cadzow head is far less distinct than either of these two, more common, with greater affinity to domesticated specimens." The cattle at Lyme Park, Cheshire (Figs. 11 and 12), were more strongly longhorned than the Chartley cattle, and like the ancient spiral-horned Emilian and Umbrian breed. These longhorned white cattle may have a cross of the German Longhorns in them.

ford's "History of Cumberland," dated 1675, writing on cattle, he says—"and white wild cattle, with black ears, only on the moores." In the same county, then, we have a breed with Urus-like markings, and also this white breed, apparently not kept in parks, but roaming about on the moors. Now, as black breeds, like the white, in a semi-domesticated state are known, why, then, should all our "wild" race be white? Martin, in his work on the history of cattle (1852), notes one of these black wild breeds. He writes:—"In the Pays de Camargue, at the *embouchure* of the Rhone, a wild, savage breed exists, less remarkable for stature

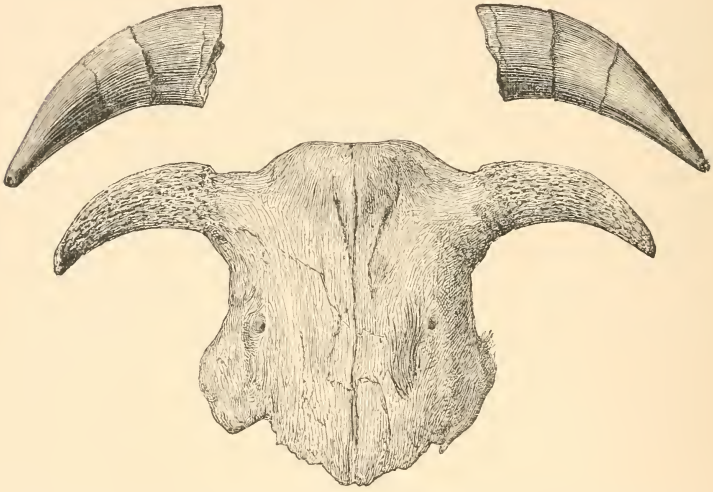

Fig. 13.—Portion of skull of small Short-horned Ox (with horns), from Castle Connell, County Limerick, Ireland.

than for strength and solidity of contour. The body is stout and robust, the belly extremely voluminous, the horns short and so arched as to form a perfect crescent, the skin is thick and covered with black hair. These cattle, which inhabit the islands of Camargue, in the mouth of the Rhone, a little below Arles, are in a semi-domesticated condition, and are noted for their strength and ferocity. They are said to have been brought originally from Auvergne. Their heavy contour, their black colour, their savage habits, and their great strength give them a certain degree of similarity to the massive Buffalo. It is this fierce breed which

furnishes the bulls for the combats of the amphitheatre, which still, from time to time, are exhibited at Nimes and Tarascon."[1]

Pliny points out, perhaps, the special feature of the *Bos primigenius* when he speaks of their terrible horns. For example, the extreme length of the horn cores, including occipital ridge, of one of the British Museum specimens is 78 inches. Urus remains are, however, not common in Great Britain, and have been most commonly found in the fenlands of East Anglia. Their remains are characteristic of the Neolithic age, or newer stone age, that of polished stone implements. Hensel, in "*Der Zoologische Garten, Frankfurt,*" for 1876, discusses the *Thur*, or *Bos primigenius*, referred to by Cæsar and many others under various names, and comes to the conclusion that there is no evidence of its having been a really wild species. So that if our white cattle were even descended from the Urus, they could not be called wild.

FIG. 14.—Highland Kyloes.

[1] In France there are many domesticated races which are white, or practically white. The Charolais cattle have big horns, and are entirely milk or creamy white. The Limousin breed are white or straw-yellow in colour, but absolutely uniform. The Race Garonnaise are of the colour of ripe corn, and the cattle of Parthenay are of the same colour, but have black legs and muzzles, and medium tapering horns. This latter breed is regarded in France as a pure one. According to Dr. Georges Pennetier there are 5 races "fauve ou blaireau," 11 races "bai clair ou froment avec nuance très claire autour du museau et des yeux ainsi qu'aux extrémités," and 4 races "blanc, café au lait et jaune clair."

With the Urus, before it disappeared, there appears a small ox, not larger than a "Kerry," known as *Bos longifrons* or *Bos brachyceros*, having small horns sharply curved forward and inward before it. If this animal be not indigenous to Britain, it must have been introduced at a very early date. This ox was present in great numbers in pre-Roman and Roman times; in fact, the Romans found no other but it in Britain, and, as already stated, their middens are full of its bones. From a skull with both horns on horn cores (Fig. 13), and having a part of the skin with the hair attached, of the *Bos longifrons* found in Ireland, we can say that in colour it was black, or dark reddish or brownish, and showed a rough shaggy hide like our Highland Kyloes (Fig. 14). According to Werner, the black-brindled Celtic cattle are the Kerry and Welsh breeds, and the red Celtic cattle are the Devons (Fig. 15), Sussex (Fig. 16), and Herefords. The Celtic Shorthorn, then a dark-coloured race, with forward small horns, was the indigenous cattle of the country.[1]

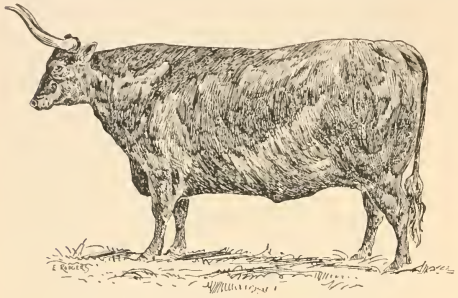

FIG. 15.—Devon Bull (old type).
From *The Farmer and Stockbreeder*, May 9, 1898.

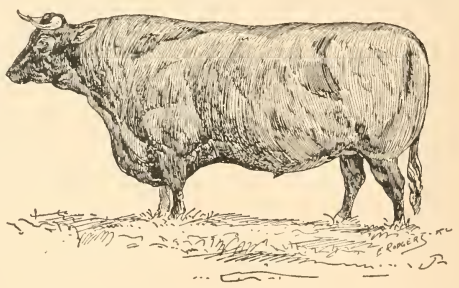

FIG. 16.—Sussex Bull (old type).
From *The Farmer and Stockbreeder*, May 9, 1898.

[1] According to Martin we have three distinct stocks—First, that from which came the Craven Longhorns of Lancashire; secondly, that from which come the Devons, Herefords, Welsh, and Scotch Highlanders. "To this stock," writes Martin, "the wild cattle of Chillingham evidently belong"; and thirdly, an ancient stock of polled black cattle from which come the Galloway and Angus cattle.

Practically we can entirely ignore *Bos primigenius* as a factor in the history of early British cattle, especially of white breeds.

On the other hand, *Bos longifrons* may have had some influence on our white breeds, though their present colour and horns differ from it. We find, according to Professor Hughes, at stations where the Romans had long resided an improved form of ox appears, a cross with an upturned-horn variety, which could only have been the ordinary Roman breed, imported by the conquerors for various purposes. These may have been

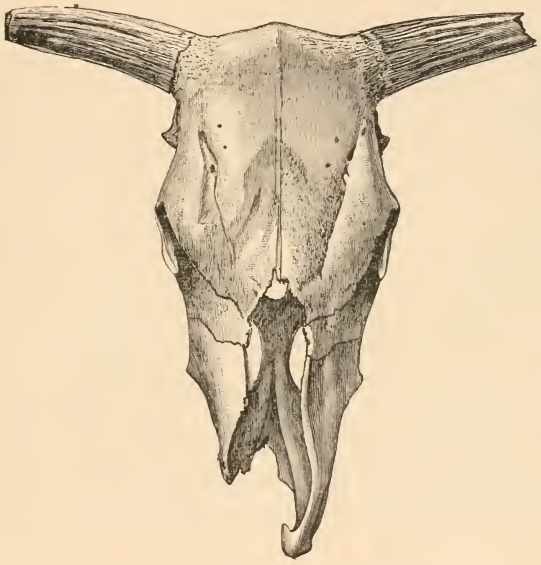

FIG. 17.—Romano-British, with horn-cores showing a tendency to turn up. Reach Fen, Cambridge. Woodwardian Museum.

a white race, more probably a dark one. Among the Celtic Shorthorns there were no parti-coloured animals, nor were they amongst those of the Roman type. Native British coins also show cattle, but never of the Urus type; they either have the conventional thick stumpy horns of a bull or those of the Celtic Shorthorn, and, when copying Roman productions, the lyre-shaped horns and dewlap of Roman cattle. A writer of last century in the tenth volume of the "Archæologia" tells us as regards "The Wild Bull," that for this creature we should see the coins of Cunobelin.

Sir John Evans, who is the authority on the subject, says that some of the coins of the ancient Britons are so distinctly borrowed from Roman originals that the bull upon them can hardly be regarded as representing any particular British breed. In some instances the bull appears to have been derived from that on the copper coinage of Massilia. Sir John Evans, however, points out in his "British Coins," when referring to the Bucranium, that "the occurrence of the bull's head on the coins of so many British princes points to some superstition in connection with it." This

FIG. 18.—Pugliesi Cattle—Prize Ox. From *Days spent on a Doge's Farm.*

superstition has not, as far as I am aware, come down to us. Sir John Evans adds that Mr. Bateman has also pointed out "that the not infrequent occurrence of the whole or part of the head of the ox in British barrows" also goes to prove the existence of some peculiar superstition in connection with it. It would be idle to conjecture if they bear any reference to white cattle.

We have now three breeds to deal with. First, the Celtic Short-horn, whose horns and colour differed materially from the white cattle of our parks. Then the Romano-British breed (Fig. 17), found only in areas long occupied by Romans, which is simply the native

breed modified and improved. The horn cores of this new breed have a tendency outward and upward, instead of the strong forward curve of *Bos longifrons*. Of this breed, Professor Hughes states, all intermediate sizes and shapes are found, from the small native to the bigger new improved. And the last is the Roman breed, with lyre-shaped horns, and agreeing with the type of animal represented on paintings, sculpture, and coins of ancient Rome.

We now turn to Rome to see what was the colour and origin of her cattle. Italy, as Bœotia, is probably the country of oxen.

Fig. 19.—Pugliesi Cattle—Prize Bull. From *Days spent on a Doge's Farm*.

Oxen were in such great demand amongst the Romans that Hesiod tells us "before all things we should have a house, a wife, and a ploughing ox." Some classical authors in their description of cattle seem to indicate the droop or curvature of horns peculiar to the *Bos primigenius*. Herodotus, describing the cattle of the Lotophagi, says, "amongst them the kine that feed backwards are met with; they feed backwards for this reason, they have horns that are bent forward, therefore they draw back as they feed, for they are unable to go forward because their horns would stick in the ground. They differ from other kine in no other respect

than this, except that their hide is thicker and harder." Pliny has a somewhat similar description of a race of cattle. He writes, "the cattle of the Troglodytæ were not like other oxen, for their horns pointed downwards to the ground, so that they were obliged to feed with their heads on one side." No doubt there is a good deal of pure imagination in these descriptions, as in that of the oxen of Phrygia, which were said to have horns as mobile as ears, but I think we can accept the form or shape of the horns to be correct; though to know what to reject or accept is to me rather difficult when I find the elephant spoken of as the "Lucanian ox," *Bos Luca*. According to the Homeric poems, bulls were found in a wild state on the Greek mountains. We are told they were "larger than our domestic bull," and "are of a tawny colour." Their hides also were used for sleeping on. In these poems we also read of two different breeds of cattle, Apollo's "heavy footed, crumpled-horned oxen," and the "herd of straight-horned kine" fashioned on the shield of Achilles. Coming to Roman agricultural writers and domestic cattle, we find a preference for dark-coloured animals.

Varro writes regarding cattle in general, "the strongest of which is the hide with the red colour, the second that with the black, the third that with the dun, and the fourth that with the white." Columella writes as regards the labouring ox, "the hair upon the whole body thick and short, the colour red or dark brown;" and Palladius also says, "the hair upon the whole body thick and short, of a red or dark-brown colour." The common oxen in Italy to-day, arising from this ancient preference, are of a reddish colour. Italian cattle are always whole coloured (Figs. 18, 19), and the voice of antiquity indicates self-coloured cattle as always having been the rule. Virgil is perhaps the only writer who declares his own toleration of motley, and, in doing so, shows they were not generally favoured by his contemporaries, yet older nations believed in motley. In the Vedic literature of the ancient Aryan people the great cow is brown and dark spotted, and called the variegated cow. Black and white cows existed, for the Vedic poet wonders why the cows of Indras, the black ones as well as the light coloured, should both yield white milk. The red cow is also mentioned as an objectionable offering to his satanic majesty. But the Aryan race believed in cattle with long horns, and have influenced other nations with the same belief. The

proverb, that "to a wicked cow God gives short horns," is at once Slavonic, German, Italian, and Scottish. In ancient Italy we learn that Umbrian oxen, specially those on the Clitumnus, were the largest and finest, those of Etruria, Latium, and Gaul being smaller, yet strongly made, and well adapted for labour, while those of Thrace were valued for sacrificial purposes in consequence of being for the most part pure white; but the cattle of Epirus, the most important pastoral district of the ancient world, were superior to all others. Pliny writes, "in our part of the world the most valuable oxen are those of Epirus;" so also says Aristotle, Varro, and Columella. The sacrificial bull (Fig. 20) was white generally, and to some of the gods only white oxen could

FIG. 20.—The Apotheosis of Homer.
(Relief in the British Museum.)

be sacrificed, Jupiter for example. But Greek and Roman sacrificial cattle were by no means always white. For certain special ceremonies black or dark cattle were prescribed, especially if sacrificing to the nether world; but, as a rule, for most of the upper world cults (Fig. 21), light coloured or white cattle, if they could be procured, were necessary. We have seen that the working cattle were dark-coloured, and we learn from our classic authors that it was unlawful to sacrifice the ploughing and labouring ox (Fig. 22). How cattle were obtained for sacrificial purposes we can conjecture from Virgil's instructions to divide herds into three parts, for the purposes of propagation, sacrifice, and labour. Dealing with dark-coloured herds, probably any light-coloured calves or albinos would find their way into the sacrificial division, and the

appearance of a white calf in a dark-coloured race was regarded as a portent generally of good. We see the same superstition current among the possessors of white cattle in this country, though reversed, the appearance of a black calf being regarded as a portent of evil, and therefore carefully done away with.[1] To this superstition, then, as one of our sources, may we trace the origin of white cattle by selection, and their retention of that colour by further selection. White animals, such as white elephants, white deer, and white asses, have been, and are, regarded with superstitious favour. They have ever been much esteemed by man. The ancient Saxon standard was a white horse, and white horses are carved on our land. Eight white horses of the Nisæan breed drew Jupiter. The priests and judges of Israel rode on white asses, and a "white bull" was in the procession at the coronation of the Pharaohs. The white bull in India to-day is very sacred to the Hindu. The Romans, when they first occupied Britain, must have imported their sacrificial bulls, and

Fig. 21.—Statue of Mithras.

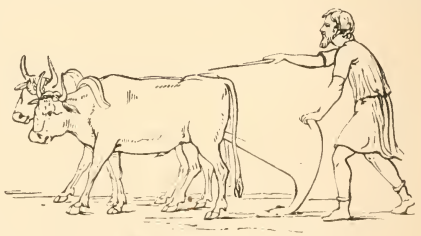

Fig. 22.—Man ploughing in his tunic. (From an ancient gem in the Florentine Collection.)

[1] Regarding our ordinary cattle, Marshall, in 1788, wrote:—"A calf entirely white is generally rejected, under a notion that white cattle are of a tender nature; that they are peculiarly subject to lousiness; and that they are disliked by their associates."

would undoubtedly look upon them as of special value. During their occupation this reverence and preference for white cattle must have spread among the people, and was never lost. Probably they held "white bulls" in esteem long before the appearance of the Romans. We are told that the Druids, clothed in white, cut the mistletoe with a golden sickle, and that it was caught in a long white cloak, and carried home on a waggon drawn by two snow-white bulls which had never felt the yoke. Our forefathers in mediæval and later days were not antiquaries or museum collectors, and did not trouble themselves about posterity. They did not keep and preserve white cattle so that we might have at the close of the nineteenth century examples of the indigenous mammalia of the country to place in our museums. They may have outgrown the superstitions of the Romans and Druids in favour of a white race of cattle, but they had apparently replaced it with a preference for its beef. To the gastronomic tastes and digestive powers of our forefathers do we owe in great measure our present breed of white cattle. White cattle, I think, were preserved in parks to supply fresh beef. All other beef was salted, and, therefore, fresh beef was a dainty. Mutton, though obtainable fresh, was not appreciated, for we are told "*chair de mouton, manger de glouton.*" According to Laurens Andrewe in "*Noble Lufe*," "an oxce flessh is the dryest flesshe amonge all other, and his blode is nat holsome to be eten, for it wyll nat lightly disieste." Andrew Boorde, in his "Dyetary," says, "beefe is a good meate for an Englyssheman, so be it the beest be yonge, and that it be not kowe-flesshe: for old beefe and kowe-flesshe doth ingender melancholye and leperouse humoures." We do not find this said about "white wild bulls;" about them we read of their "sweetnesse" of flesh. Topsell, in his "Historie of Foure-footed Beasts," published in 1607, gives a print of what he calls "the white Scotian bison," and he says that the "white Calidonian or Scotian bison" are "now growen to a small number," and that "their flesh is very pleasant, though full of sinewes." This is, however, a digression, for we are, in our argument, still seeking in ancient Italy for the type of our park cattle. Looking at the existing labouring cattle of the south of Italy, we see in them the old Roman breed, with upturned lyre-shaped horns and a well-marked dewlap, as shown in Roman wall

paintings and coins. These cattle are always whole-coloured—generally mouse or fawn standing off to white, the insides of the ears, the muzzle, and whole of the end of the tail being either black, reddish, or pink. These cattle found in South Italy probably came from Egypt, where their points had already been stereotyped through ages of domestication. In North Italy, in Emilia, and Umbria, there is a large animal with enormous horns growing spirally outwards from either side of the head. In colour it is like the breed in the south, and it no doubt came originally from Podolia.

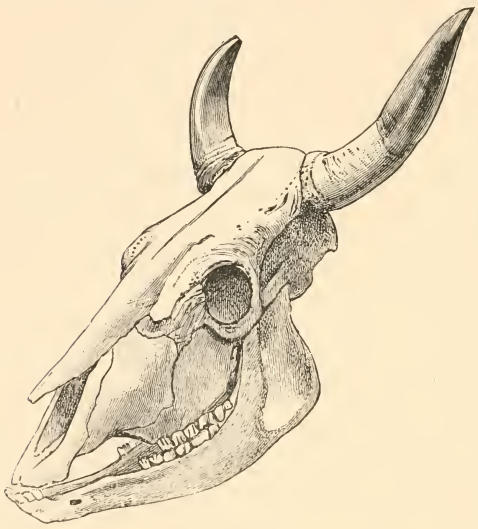

Fig. 23.—Chillingham Bull. British Museum.

Martin, in his work on cattle already referred to, writes—"In the Campagna of Rome a very fine race exists in a semi-wild state under the care of keepers or *vaccari*. Some of the bulls are extremely noble animals, often white, others are grey; the horns are large, well turned, and pointed."

As it would be interesting to compare this semi-wild race with our own white herd, I applied to the British Consul at Rome for assistance to obtain more exact information, and his reply is interesting. He writes—"It appears that none of the herds at present existing in the Campagna can be described as white cattle, such as may have been used for sacrificial purposes in ancient Rome. The only breed of which I have heard answering the description given by Horace and other classical authors is to be found on the banks of Clytumnus, near Perugia—quite a special locality, not to be confounded with the country round Perugia generally."

It has been pointed out that, both in our white park cattle and the south Italian breed, the black and red points are probably the character due to reversion to a primæval race; the pink, on the other hand, being rather the perpetuation of albinism by selection. We have now an existing domesticated white race in the south of Italy, and an existing so-called wild white race in this country. An osteological examination of the two races has been made by Professor Hughes, and he writes—"If we compare the skeleton and skull, especially of the modern Italian bull, with

FIG. 24.—Modern Italian Bull, with short upturned horns. British Museum.

that of our Chillingham bull, we shall find them to be almost identical." In the British Museum there are skulls both of the Chillingham and Italian races (Figs. 23, 24), the former measuring 18 inches by $7\frac{1}{4}$ inches, and the latter 23 inches by $8\frac{3}{4}$ inches. They both have upturned horns, and the set of the horns on the head is identical. A comparison of the skeletons also shows no essential difference. Professor Hughes (*op. cit.*, p. 20), on this point, writes—

"If a selection of the lighter-coloured individuals of the common draught ox of Italy were turned out in a park in England, no one would suspect that they did not belong to the wild white breed. There would be less difference between them and the Chillingham cattle, in essential characters of form and colour, than there is, for instance, between the Chillingham and Chartley herds (Fig. 25). In both the wild cattle and the Roman breed we have a rectangular animal, with upturned black-tipped horns, a tendency to be symmetrically shaded from a mouse or dun or fawn colour to white, black or pink-lined ears, and black tail ends."

Fig. 25.—White Cattle, Chartley Herd.

Seeing that the claims of our park cattle to be descendants of *Bos primigenius* rest solely on the opinion of Professor Rütimeyer, a comparative osteological examination of the English park cattle and the *Bos primigenius* would, in my opinion, be of service. Unfortunately, our distinguished scientific naturalists acknowledge that they know and care but little about domesticated breeds of cattle, of which they regard the white park cattle as one; and they also think, seeing the close similarity of the bones of cattle generally, that no results of any importance would accrue if such were undertaken.

It has been noted that the original source of the cattle in the south of Italy is said to be Egypt, and these are in turn said to be derived from the Zebu or *Bos indicus*. This humped race is practically white, and no wild type is known. A feral race existed in India, to which reference will be made later. Murray, in his "Geographical Distribution of Mammals," considers the Zebu to be the parent stock of all cattle, and Rütimeyer advances the opinion that the Zebu was the progenitor of *Bos longifrons*. The Zebu is an Eastern animal, and the seat of the origin of the ox is also said to be in the East, though it has generally been assigned to a part of Asia not very remote from Europe. Darwin and other naturalists, however, dissent from Rütimeyer's and Murray's views. Yet we know that Zebus and ordinary cattle breed freely, and it is a matter of common observation in India that in such cross-breeds the hump of the Zebu disappears. It is said that the descendants of the Indian Zebu, crossed by the late Earl of Powis with English cattle, were "extraordinarily wild." The Zebu has also been crossed with Devons by Mr. Parsons. These humped cattle, called "Indian cows," "Indian bulls," and "Brahminy cattle," are to be found in England, as far as I am aware, at Charborough Park (Dorset), Dunstall Park (Stafford), Arundel Park (Sussex), and Rigmaden Park (Westmoreland). A herd of these cattle, if the hump be kept out of view, looks very much like our "wild white breed." Again, the skull of the Kalmuck ox found in Russia closely resembles that of the Zebu, and we have both horned and hornless Zebus. The "bagoudha" of the North-West Provinces in India, is simply a hornless Zebu of a dull-white colour, and in Palestine we find white hornless cattle without humps that bear a strong likeness to Zebus. The Zebu is the white animal of the East. Oriental wild cattle, such as the Gaur, Gayal, and Banting, being in colour dark-brown or blackish to reddish-brown. Gayals are kept in several English parks, I believe. Vasey makes the attempt to distinguish between the Zebu and the ox by noting that the former has 4 sacral and 18 caudal vertebræ, while the latter has 5 sacral and 21 caudal vertebræ. But if we turn to Flower's "Osteology of the Mammalia," we find in the table given there that *Bos taurus* has only 19 caudal vertebræ, while apparently *Bos primigenius* has none. Too much stress then cannot be put on the number of vertebræ. They may have been lost or not

found, in the case of the specimen described. Before leaving Egypt, it may be noted that representations on Egyptian sculptures show that there was both a horned and a hornless breed. Of the horned variety there were apparently two breeds, one long-horned and one short-horned, both being of one uniform colour, while the polled cattle are parti-coloured. Polled cattle are also represented on Roman coins between B.C. 490 and B.C. 27. Egyptian sculptures show also a humped breed. Another variety is found at Thebes. They are white and black in colour, low in the legs, with the horns hanging loose, forming small horny hooks, nearly of equal thickness to the point, and hanging against the cheeks. The Assyrian sculptures show a stronger breed, with an animal more robust in body and having thicker horns than the animals of the Egyptian monuments. Besides Egypt, there are other channels through which white cattle entered into ancient Italy. Varro remarks that white oxen were rare in Italy, but the rule in Thrace, which is separated from Asia by the Bosphorus and Hellespont. These, it is conjectured, may have been Scythian cattle brought by the Iranian pastoral tribes and afterwards introduced into Italy. It may be interesting to note that Scythian cattle are said to be stumpy-horned by Herodotus, while Hippocrates says they were hornless. Tacitus says the same of some German cattle, which "lacked the glory of the brow." The Eubœan breed, of which we read "whence our poets say white-cowed Eubœa," was also white, and would probably have the same origin, for Eubœa was early connected with Thrace and the north. Another recruiting ground for white cattle would be the Roman Province of Pannonia—that is, the eastern portion of Austria, Carinthia, Carniola, Hungary between the Danube and Save, Slavonia, and portions of Croatia and Bosnia. In this region—a classic cattle one—three nomadic races encamped, and in turn drove each other out. Each brought new races of cattle with them, and these, perhaps, were better ones than those the district inherited by antiquity from the primitive world. The three races are represented by (1) the white Ukraine or Podolian or Hungarian ox; (2) Steppe cattle, small in size and red in colour; and (3) Kalmuck cattle of Tartar or Mongol hordes, small, and red in colour. The Ukraine oxen are large and greyish-white in colour, sometimes with tawny bodies and white faces, long-legged and long-horned, with upward horns,

White Cattle Ploughing in Italy.

and are akin to the large white oxen, with long horns wide apart, found in Italy south of the Po, also to the cream-coloured ox of Lombardy [Pl. VI.], and to oxen in Spain and Algiers. In ancient Rhætia, *i.e.*, modern Grisons, the Tyrol, and northern parts of Lombardy, we find to-day a tall, slightly-built breed of silver-grey horned cattle. From Columella and Pliny we learn that in Venetia and the Alpine districts a small insignificant race of cattle existed that were good milkers.

In the Austrian-Hungarian Empire there are about 9 distinct races and 22 breeds of cattle at present recognised. About six of them are white or light yellowish-grey, but two of them—the Hungarian and Podolian breeds—are pure representatives of the original type. In colour they are generally white, shading to silver-grey. The ears are dark inside; muzzle and feet black. The horns of the Hungarian breed are long and wide-spreading, tipped with black, but carried uprightly. In the Podolian breed the horns are black, well turned up, and not extra long. The Transylvanian ox may be noticed, as it also is like the true Hungarian, but has more spreading horns. I have been favoured, through the kindness of the Secretary of the National Agricultural Society of Hungary, with an unique collection of photographs, fourteen in number, showing Hungarian white bulls, cows, and working oxen. With reference to these photographs, the Secretary writes me that all the animals were bred on ranges (Puszta) quite wild, their food being pasture only, except in winter time, when they get hay.[1] The breeding animals also get some grain. In the opinion of the National Agricultural Society's Secretary, this race is very strong, hardy, and contented, and, to use his own expression, "persistent against all pests." The race is very good for farm-working, and for feeding up for beef, but the cows give little milk. There are two varieties of cattle or lines of breeding. The one is the race or breed of the great plains (Alföld), while the other is that of Transylvania. The former race is taller, but not so hardy as the

[1] These animals, before being broken in to work, are as wild as our park cattle. They hide their young, fight for leadership, the bulls give battle when surprised, and they cannot be approached by strangers, as they will attack them unless they are accompanied by their own herdman, who, like the cattleman of the West, lives in the saddle.

latter, which bears more the character of a mountain race—smaller, very strong, and much more hardy. One point deserves special attention—the prepotency of our present white Hungarian and South Italian cattle are generally acknowledged, and this further points to an ancient breed with a strong prepotency of transmission. It is, no doubt, to this power in the cattle imported by the Romans that we owe the present markings of our white park cattle. Without selection, and under feral conditions, cattle revert, become whole-coloured, and assume lighter colours only if such be the character of the original stock. Darwin, Sanson, and Feser all agree in saying that yellow or

Fig. 26.—Picture from Pompeii (from *Storer*).

fawn colour is noticeable, and comes out commonly when there is reason to suspect a commingling of two or more ancient breeds. Before passing away from the white domestic cattle of the Continent, I must refer to the white cattle of Roumania. Here, throughout a country as large as England and half of Scotland together, there is only one breed of cattle—a white race—and these cattle to-day maintain much of the form and stamp of the oxen figured on old Roman frescoes (Fig. 26). Writing about these cattle, in the *Live Stock Journal*, Mr. William Carnegie says:—"White is far and away their predominant colour, although some of them trend towards a dun to brownish hue on their upper and

outer portions, while occasionally almost black beasts are seen, the darker colouring being due to a more or less distant cross with the Buffalo,[1] which is also numerous in parts of Roumania. But, putting occasional colour-sports to one side, the colour of the Roumanian cattle is white, and white only. The hair is coarse and long, as befits a beast that may have to withstand the rigours of the Roumanian winter in the somewhat ramshackle wooden buildings which do duty for byres on most of the farms, the holdings of peasant-proprietors or peasant-tenants. It is shed freely for the summer, when equally great heat prevails; but the coat is always thick, coarse, and somewhat bristly, thus offering very necessary protection against the multifarious noxious insects which afflict cattle in this country. Large, heavy, spreading horns adorn the, comparatively speaking, light-formed heads; the eye is bright and black, the ears large and hairy. The general build is heavy and massive, resembling more our Herefords than any other British breed. They are big-boned cattle, standing on large and spreading heavily-hoofed feet, varying, however, in size, according to the districts—whether poor or rich—from whence they come. Thus, in the arid and sparsely-cultivated wastes of the Dobruja they run quite small, whilst on the rich plains on the other side of the Danube the bigger beasts are reared. They are slow in arriving at maturity, but regular and fertile breeders, the cows giving an abundance of rich creamy milk. Throughout the summer they are pastured on the lower-lying, somewhat marshy lands, which begirt the streams and rivers, and are housed in barns and yards throughout the winter."

Our evidence, so far as to the origin of our white cattle, may be thus summed up:—

1. The ox common and universal throughout Britain, and we may add Ireland, at the time of the Roman Conquest was the Celtic Shorthorn, the *Bos longifrons* of Owen.
2. This animal was small and dark-coloured, and such we find to be the existing type of animals in the regions to which the Celts were ultimately driven and confined.

[1] This is doubted by experts, and Mr. Carnegie in a subsequent communication to the *Live Stock Journal*, acknowledges that he has no personal knowledge of such a cross.

3. At the time of the Roman Conquest the Gigantic Ox, *Bos primigenius*, was extinct in Britain, while the Celts had domesticated the *Bos longifrons*—the Celtic Shorthorn.
4. This animal was utilised and consumed both by the Celts and Romans.
5. The Romans, for draught and ploughing, preferred dark-coloured oxen. For religious rites and ceremonies, public and private, white oxen were necessary.
6. These white oxen were to be found in various provinces and colonies of ancient Rome as domesticated breeds, and the descendants of these cattle are to be found within the same areas to-day practically unchanged, when we compare them with the representations of their ancestors on wall-paintings, sculptures, coins, and gems.
7. That such cattle, carrying with them the prestige of sacrificial animals (Fig. 27), admired, selected and preserved, were brought into Britain, we know from the Roman middens. Their size and the erect lyre-shaped form of their horns, when compared with the native Celtic Shorthorn, admit of no mistake.

Fig. 27.—Suovetaurilia
(the triple sacrifice of bull, sheep, and pig).
(Relief in the Louvre.)

This is the point we have reached in our argument, but we can safely take two steps further. The middens, at long-established Roman stations, show us that a new breed had been effected by crossing the Roman imported cattle with the native Celtic Shorthorn. The result was, according to Professor Hughes, a larger animal, and, as already mentioned, with horn cores which were neither that of the native breed nor that of the imported race. What the colour of this cross was we cannot definitely say, but suppose from the known prepotency of the Roman breed that it would be white. At the same time, the Roman breed and the cross formed a very small part of the cattle population of the country. We may fairly assume, I think, that the large white breeds of cattle which came from the Roman province lying at the south-eastern corner of Europe, into Rome itself, also found their way into Britain

while it was a province of the Roman Empire. We know that the Romans imported British bulls (of which our black Welsh are descendants) for the spectacles of the amphitheatre, and the colour to this day of the bulls which appear at bull-fights is black.

After the evacuation of the country by the Romans there followed a period of unrest. The country was subject to waves of invasion, all the invaders bringing their own breed or class of cattle with them. As they came they pushed back their predecessors till the Celts, the first comers, with their cattle—native, Roman, and cross—came to what is now known as the Celtic fringe. Yet through all this turmoil the superstitious or traditional regard inherited from the Romans, and even from the Druids, for white cattle must never have been lost. The cult of the sacrificial bull seems to have impressed itself deeply on the inhabitants of these islands. As far north as the Moray Firth thirty figures of bulls, of stone and Roman handiwork, have been dug up on its shores. We read of bulls being killed "as an alms and oblation to St. Cuthbert" in the twelfth century at Kirkcudbright. In Mitchell's "Past in the Present" an extract is given from the records of the Presbytery of Dingwall. That body met on 5th September, 1656, to inquire into the backsliding of a parish within its bounds, and they find "amongst uther abhominable and heathenische practices that the people in that place were accustomed to sacrifice bulls at a certaine tyme uppon the 25 of August." I think it will be allowed that our forefathers, from the dawn of history, have had a reputation as cattle breeders, consequently they would be more apt to retain customs and superstitions—Druidical, Roman, or Saxon—which applied to cattle, than to any other thing. If it can be shown that some of these superstitious customs have come down to comparatively recent times, it will, I hope, be admitted that the reverence for white sacrificial cattle would also be as strong among the people. One of these customs in connection with cattle is recorded in the *Gentleman's Magazine* for February, 1791, as being a common practice in Herefordshire and Gloucestershire. It is termed "the antient ceremony of wassailing." The correspondent in the *Gentleman's Magazine* writes that "on the eve of Twelfth Day, at the approach of evening, the farmers, their friends, servants, &c., all assemble, and near six o'clock all walk together to a field where wheat is growing;" here

twelve small fires and one large are lighted, and the company pledged in old cyder. In the wheat field "a circle is formed round the large fire, when a general shout and hallooing takes place, which you hear answered from all the villages and fields near; as I have myself counted fifty or sixty fires burning at the same time." This being finished they go to the house for supper, here "a large cake is always provided, with a hole in the middle. After supper the company all attend the bailiff (or head of the oxen) to the Wain-house, where the following particulars are observed:—the master, at the head of his friends, fills the cup (generally of strong ale), and stands opposite the first or finest of the oxen; he then pledges him in a curious toast; the company then follow his example with all the other oxen, addressing each by its name. This being over, the large cake is produced, and is with much ceremony put on the horn of the first ox through the hole in the cake; he is then tickled to make him toss his head. If he throws the cake behind it is the mistress's perquisite; if before (in what is termed the boosy), the bailiff claims the prize." This custom is recorded as a Saxon custom, but the wassailing bowl is the grace-cup of the Greeks and Romans, and the ceremony that of Feriæ Sementivæ. Here, I think, we find an example of how customs regarding cattle have been preserved in this country. From another source I think I can find confirmation for the theory that bulls, which for Roman and Druidical ceremonies had to be white, were held in reverence by the people generally, and in connection with which the colour white would play an important part. This is the derivation of the names of our farming stock. According to Paley the generic names of our farm stock, as "cow," "calf," "kine," "ox," for the most part occur in the Saxon, and contain roots not represented in either Latin or Greek; but the root of the word "bull," which is a particular and descriptive name, may be traced in the classical languages. The words "beef" and "veal" come to us from the Normans. The history of these common words is interesting. From the Normans we get our words for the flesh, from the Saxon the generic names, and from the Romans the specific name "bull" of our farm stock, as represented by cattle. "Bull" thus has maintained its individuality through Saxon and Norman times, and there must be some reason for it. Was it through ceremonies in which the "white bull" figured?

From ancient records we learn that, in the early days of English history, white cattle were valued higher than coloured ones. We are told that 100 white oxen were equal to 150 black oxen. They were utilised as money, and in demand when fines had to be paid. For this reason white cattle were selected, placed in charge of herds, and kept together in enclosures in order to have a supply ready when required. They were domesticated cattle. Many proofs can be adduced in support of this statement. Professor Low pointed out in his "Domestic Animals," published in the early part of the century, that in the area in which the Black Pembrokes were reared practically wild, that is, uncontrolled, there was also reared a domesticated breed known as the white forest breed. The story of Twm Sion Catte, who was born in 1590, quoted by Professor Hughes (*op. cit.*, p. 24), also illustrates this point—"a pair of oxen were ploughing together, one was black and the other was white. Twm wanted to steal the white ox, so he drew the boy away from his charge by letting out a wired hare in front of his corgi, and, as the dog was gaining on the hare, the boy could not resist the temptation and followed, looking back from time to time to see that the white ox, at any rate, was safe. Twm, watching his opportunity, threw a white sheet over the black ox and drove the white ox away." The points this story illustrates are, I think, that the white ox was as domesticated as the black ox, but that it was regarded as much more valuable we learn from Twm's desire to steal it, and the ploughboy keeping his eye on it. The suggestion made by Mr. Housman is, I think, very probable, namely, that the white cattle were large animals when compared with the native black breeds, and were valued for their size. Compare a Hungarian ox with a Kerry, or even a Kyloe, and some idea of the difference in size, which must have appealed to the eyes of our ancestors, will be apparent. Another illustration that white cattle were domesticated can be given from an Irish zoological and topographical poem as old as the ninth century, published in the *Proceedings of the Royal Irish Academy*. The poem begins:—

> "I then went forth to search the lands,
> To see if I could redeem my chief,
> And soon returned to noble Tara
> With the ransom that Cormac required."

The poem, 80 lines in length altogether, then goes on to detail the animals brought as the ransom, and where obtained. After detailing where he got foxes, otters, gulls, and ravens, the tenth line reads—

"Two wild Oxen from Burren."

A footnote informs us that Burren was a wild district in Clare, and at the time was regarded as one of the three impassable places in Ireland. Now, wild oxen does not mean wild white cattle.[1] On a close examination of the various authorities that have been quoted by writers on the natural history of our white oxen, I find that it has often been taken for granted that a reference to wild bulls, or *Bos sylvestris*, necessarily implies a white race. The last nine lines of this poem show us that such is not the case :—

"Two Cats out of the Cave of Cruachain.

Two *Cadhlas* (Goats) from Sith Gabhran,
Two Pigs of the Pigs of MacLir,
A Ram and Ewe both round and red,
I brought with me from Aengus.

I brought with me a Stallion and a Mare,
From the beautiful stud of Manannan,
A Bull and a white Cow from Druim Cain,
Which were presented to myself by Muirn Munchain."

Here we see that wild oxen does not imply white oxen, and that white cattle were domesticated, being classed among other domestic animals, and considered of very high value. With the white bull and cow the poem ends, and the reciter's greatest achievement is thus recorded, while the speaker draws attention markedly to the fact that these cattle were presented to him by, we suppose, their breeder. Another factor, we think, which points to the white race being kept by our forefathers as a domesticated one, is the number of herds of white cattle that exist, and have existed, under domestication in Norfolk and Suffolk, Yorkshire and Cheshire. All these cattle have been polled, that is, hornless, a characteristic which in itself indicates

[1] Wild oxen probably means feral cattle. Bede, for instance, affirms that in Ireland in his time wild goats were hunted ; yet he goes on to say that the country did not anciently possess any wild goats.

a long period of domestication.[1] Polled white cattle with black points are, or have been, kept at Somerford Park, in Cheshire, Wollaton, Notts., and Burton Constable, Yorkshire. The domesticated polled white cattle at Somerford Park, Cheshire, have been there for over 200 years. Domesticated white cattle, with red or brown points, used to be at Gisburne, Yorkshire, and Whalley Abbey, Lancashire. The domesticated white cattle at Gunton and Bickling, in Norfolk, had black and dark-brown or red points. At Woodbastwick and Brooke, Norfolk, the points were red and dark-brown or black and brown. At Stanton Hall, in Suffolk, in 1894, half of the domesticated white polled breed had black points, the other half red points. Polled white cattle have also been kept and termed wild at Middleton in Lancashire, Ardrossan in Ayrshire, and Hamilton, Lanarkshire, but at the latter place they have now been furnished with horns. At Rambouillet, in France, an ancient white hornless breed was also kept, which, unfortunately, was exterminated in 1815 by the cattle plague. Further, a domesticated race of white cattle, horned, with red ears, is known to have existed in Wales in the tenth and twelfth centuries.

With regard to the polled white cattle at Middleton, said to be wild, it is rather a curious circumstance, I think, that Leigh, in the "Natural History of Lancashire," says that in 1700 these wild cattle were supposed to have been brought from the Highlands of Scotland, which shows that a polled white breed existed then in Scotland. The cattle at Hamilton (Cadzow Forest or Chatelherault Park) are known to have been once polled. Martin, writing in 1852, says, "The semi-wild cattle of Chatelherault Park, in Lanarkshire, the descendants of an ancient race, are mostly, if not always, polled." Dr. Knox, in his memoir on "The Wild Ox of Scotland," published by the Royal Society of Edinburgh in 1837-8, speaks of the Hamilton cattle as polled, and notes that a cross between a white Hamilton bull and a Shetland cow produced a polled ox nearly quite black. About the same date, 1835-6, a writer in the fourth

[1] Polled cattle are to be found in Southern Norway, and it is stated that our big polled white cattle came to Great Britain 800 years ago with the Baltic Rovers.

volume of the *Quarterly Journal of Agriculture* says :—"With the exception of the aboriginal breed of cattle, a few of which, polled, and of a dingy white colour, are still to be seen in the park of the Duke of Hamilton at Cadzow, the West Highland or Kyloe breed is the oldest in Scotland." It will be noticed that the Hamilton cattle are not termed "wild" by this writer. About this period—1838—Lord Tankerville, who inspected the Hamilton cattle, wrote:—"They have no beauty, no marks of high breeding, no wild habits, being kept, when I saw them, in a sort of paddock; and I could hear no history or tradition about them which entitled them to be called wild cattle." Though Lord Tankerville is not a disinterested, yet in one sense he is an expert, witness. Being polled, the cattle would probably be a domestic breed.

Mr. Lofft, of Troston Hall, has pointed out that the white polled breed was much more common in the last century than we think, or the owners of herds of white cattle care to admit. For instance, he points out that Ward, the elder, who painted in the eighteenth century, was particularly fond of introducing into his landscapes this sort of cattle. In a large landscape by this painter in the National Gallery, London, there stands in the foreground, a grand white polled bull with red ears. In the same gallery there is another picture, much smaller, with a white bull, also with red ears. In another landscape is shown a white-horned cow, with red ears.

I have quoted the remarks of Lord Tankerville on the Hamilton cattle. It is but right, I think, to say that the purity of the Chillingham cattle [Pl. VII.] is not above suspicion. A question often asked is, what became of the wild cattle that used to be in Drumlanrig Park? Ramage, in his work on "Drumlanrig Castle and the Douglases," published in 1876, says:—"There is a tradition that, about a hundred years ago, the whole stock was sold and driven off *en masse* to Chillingham, the seat of the Earl of Tankerville, in Northumberland, *via* Durisdeer and the Waldpath, and as they were rather an unruly drove, they were accompanied to the confines of the county by almost all the men and dogs in the surrounding district."

I think it must be admitted that, when you have a whole countryside participating in a drive like this, the tradition of it will be

From Photograph by *John Fleming.*

White Bull—Chillingham Herd.

fairly accurate within the period named—100 years. I think I have evidence that this tradition is a correct statement. In Vol. X. of "Archæologia," the Rev. Samuel Pegge, writing in 1790 on "The Wild Bull," says:—"The late Marmaduke Cuthbert Tunstall of Wycliffe, Esq., sent me a print, not long since, of the wild bull of the ancient *Caledonian* breed, now ranging in the park at Chillingham Castle, in Northumberland. Mr. Tunstall was no contemptible judge of these matters." I think this notice shows that the Caledonian breed was a recent acquisition at Chillingham. I may say that I find that the Drumlanrig tradition was discussed by the Newcastle Antiquarian Society, but held to be incorrect, as the Land Agent for Lord Tankerville stated that the Chillingham cattle had been imparked for 400 years. Yet, according to the County historians, Chillingham Park does not appear in the Elizabethan maps, so that the subject still needs to be inquired into.[1]

I have now directed attention to this imported race, which made its appearance with the Romans, or was imported previously by the Druids, and round which Druidical and Roman traditions and superstitions gathered, and by raising it apparently to a higher level, either on account of colour, size, or some other quality than the common cattle, has led to its being valued and preserved as it has been.

Mention has been made of the cross breed between the Celtic Shorthorns and Roman cattle. This cross (the first cross in British live stock) apparently did not stand, or reverted, for the hundreds of horn cores found in mediæval ditches show that the cattle then were of the *Bos longifrons* type pure and simple. These cattle would all be dark-coloured, probably black. Dr. Murray, the editor of the "New English Dictionary," had a query in "Notes and Queries" regarding black cattle as a term, which he was informed, and he found some dictionaries said, meant all boves without restriction of kind or colour. Webster

[1] It is admitted, I believe, that at one time the breed depended on some of the cows producing a bull calf. It is also interesting to find that the specimen given to the British Museum in the early part of this century is entered in the catalogue (page 79) as under:—

"83 g. White Scotch Bull, stuffed, Chillingham Park. Presented by the Earl of Tankerville."

says that black cattle means any bovine cattle reared for slaughter in distinction from dairy cattle; and in the "Encyclopædia Londinensis" (1810) I find it stated that—"Cattle are distinguished into large or black cattle and into small cattle; of the former are horses, bulls, oxen, cows, calves, and heifers; amongst the latter are rams, ewes, sheep, lambs, goats, kids, &c." The same work says of "horned cattle" that—"The original appellation appears to have been that of *black cattle*, from whence was understood ox, bull, or cow; and the reason assigned is because formerly these animals were all entirely black in every part of this island; and that the mixture of other colours has been wholly fortuitous, and introduced by bringing cattle across the channel from the opposite shores." The Saxon word *neat* [cattle] implies horned and black. It is said to be closely related to the Friesic *ned*, *nat*, which means particularly horned cattle; to the Danish *nöd*, or black cattle; and to the Swedish *nöt*, which also means black cattle. It is curious, if white was the colour of our indigenous cattle, that no word survives in our farm vocabulary which would point them out as clearly as black cattle are indicated.[1] Such a wide meaning to black cattle, I think, supports my conjecture, and I think further indicates that while cattle used to be compared with them, oxen was a great factor in the economy of our forefathers; in fact, absence of oxen is a sign of enclosures and a change to farmers from peasant-proprietors. The villein had his own "catel," and preferred them to horses, as they were "mannes" meat when dead, while the horse was carrion. But these animals would be inferior in size to the white cattle, and these, we learn, were preserved in parks attached to

[1] In the *Gentleman's Magazine* for 1756 we read of "a fair for the sale of black cattle once a fortnight." Before 1805, when Shorthorns began to be kept south of the Tweed, Scotch cattle were black. The Shetland cattle were uniformly black and diminutive in size. Then the Orkney cattle were of the same colour, but larger and coarser. Like these were the North Highlanders, the native breed of Sutherland, Ross, and Inverness. Next came the small breed of "Skibos," like the Kerries, the large-horned Aberdeen cattle, the small-horned or Brae cattle, and the Falkland or Fife breed. Of the polled types, there were the Angus Doddies, intermediate between the Buchan Doddies and polled Galloways. These breeds were all black in colour, and practically covered the country.

religious houses, their flesh being more esteemed by the abbots and monks, we are told, than that of their "awne tame bestial," and even, as I shall show further on, used in religious ceremonies.

From the twelfth to the sixteenth centuries, Professor Thorold Rogers says, the cattle of England were small, averaging four hundredweight, while there was no great variety of breed. Professor Thorold Rogers adds—"In all likelihood the breed was the small one now found in Scotland and other mountainous regions." Between 1583 and 1702 cattle seemed to have improved, as in that period, Professor Rogers says, the average weight rises to five hundredweight.[1] England once did a large trade in cattle and meat with Germany and the Continent, but it was in the twelfth century. It would be interesting if we could find out whether this trade was in the ordinary dark-coloured *Bos longifrons* or in white cattle, which were, as we have abundant evidence to show, in favour and demand in England at that period.

In Switzerland we find confirmation of the theory offered regarding our own cattle. The Celtic Shorthorn is the indigenous ox of the country, and to-day we find in the mountains, breeds that are whole-coloured, with horns placed outwards from the side of the head and turning more upward and forward, while in the lowlands the breeds are simply of the Italian type. It is strange that herds of white cattle do not exist in Ireland, and that no claim has been made on our imagination for wild white cattle, huge as elephants and maned like lions, to be allowed to roam through impenetrable forests in that island.[2] Yet, in the earliest Irish annals we read of the "island of the white cow" and the "lake of the white cow." As stepping-stones, so to speak, to Ireland, we have Anglesea famous as the "isle of cows," and Iona, but here we learn there were no cows, as St. Columba wisely ruled that "where there is a cow there will be a woman, and where there is a woman there will be mischief." Perhaps St. Patrick

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[1] The average produce of the carcases of Chillingham cattle is, I believe, about 560 lbs., and this represents the average weight of carcases sold at Smithfield two centuries ago, before the modern improvement in breeding began.

[2] A German Prince is stated to have hunted and killed at Glengariff, in Ireland, a wild bull about 1828-29.

held similar views, for, though in his days there was a "deacon of the ass," neither the ox nor the cow was so honoured.

I have pointed out that black cattle—the Celtic breed—are to be found on the western and northern coasts of Britain. In turn, they are the prevailing type in Ireland. According to Wilde, four types existed :—

1. The Irish straight-horned (Fig. 28), in colour black or red. It is the skull of this animal that, in Wilde's opinion, is the same as that carved on the friezes of Grecian temples, and it was the animal "used in sacrifice by the early Greeks and also by the Hebrews and other sacrificing nations."

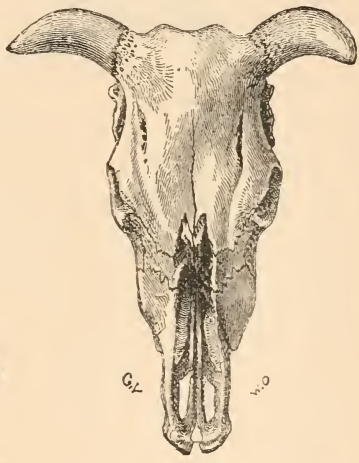
Fig. 28.—Irish Straighthorn.

2. The Irish Longhorns or Connaught ox, red or brindled in colour. These animals had wide spreading horns, turned so completely inwards that they either crossed in front of or behind the mouth, or pressed so much inwards towards the cheek as to cause irritation to the animals and require amputation.

3. Irish polled or Moylé cattle, said to have been common even fifty years ago. In colour they were either dun, black, or white.
4. The Kerry cattle, black or even red in colour, having short horns turning upwards, and being small in size. This existing and docile breed is reported of in the days of Elizabeth and Charles II. as being exceedingly ungentle and "as wicked and rebellious as the people."

This summary will show, I think, that Ireland has had samples of all the most ancient types of cattle, but the wild white bull is not in evidence.

I would now again summarise what are the points I wish to emphasise before I direct attention to the historical evidence which, I think, allows us, at any rate, to say that the various attributes given to our white cattle, such as being indigenous and roaming wild in dense prehistoric forests, &c., are improb-



FIGS. 29, 30.—Irish Shorthorns.

able, if not impossible. I cannot sum up better than in the words of Professor Hughes, who, in "Archæologia," vol. lv., p. 34, says that we may take it as pretty well established that "the Urus characterises the Neolithic age, having first appeared in Palæolithic times with the Bison, and having become extinct in Britain long before the Roman occupation. The Celtic Shorthorn appeared with the Urus in Neolithic times, lived down and through the Roman occupation, and thus may be regarded as the characteristic ox of the Bronze age. The Romans improved the Celtic Shorthorn by crossing it with cattle imported from Italy. The form of the Roman ox, as inferred from contemporary art, being

exactly what was required to produce the modification observed in the latter Romanised breed. The characteristics of the Urus nowhere appear among the Romano-British cattle.

The Kerry cattle are the most typical examples in the British Isles of the Celtic Shorthorn, while the Chillingham cattle are the nearest representation of the breed introduced by the Romans.

The Highland and Welsh cattle are derived largely from the Celtic Shorthorn, with more or less mixture of the Roman breed. All the above are whole-coloured or shaded.

Fig. 31.—Horn-core from mediæval ditch. Woodwardian Museum, Cambridge.

The Longhorns, which appear nowhere with Romano-British or early mediæval remains, are the offspring of the large breeds imported from Holstein and the Low Countries in later mediæval times. All these, and the stock crossed with them, are apt to be parti-coloured or sheeted.

The Mediæval Shorthorn (Fig. 31), as found in the ditches, &c., of the eleventh, twelfth, and thirteenth centuries, is a reversion to the numerically-predominant native breed (Celtic Shorthorn) after the legionaries had been withdrawn, and selection and breeding had become impossible."

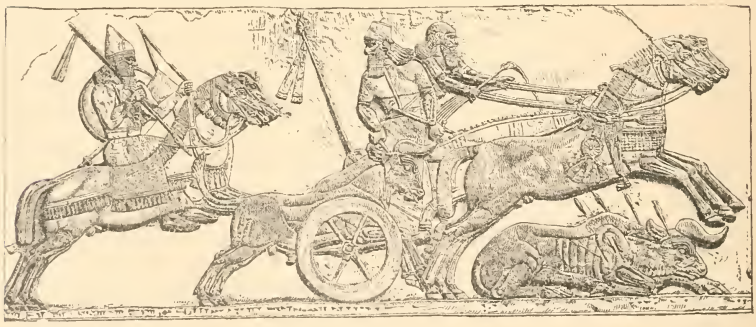


Fig. 32.—Hunting the Wild Ox. British Museum, Assyrian Sculptures.

[On behalf of the Publication Committee, I have to thank the following for assistance towards the illustrating of Mr. Hedger Wallace's paper:—Dr. Harmer, F.R.S., Curator of the Museum of Zoology in the University of Cambridge, for procuring the photograph of the skeleton of *Bos primigenius* presented to that Museum by Professor Newton; the Keeper of the National Museum of Antiquities, Edinburgh, for the use of the blocks for Figs. 2, 3, and 13, from Dr. J. A. Smith's paper in the *Proc. Soc. Antiq. Scot.*, ix., Pt. II.; Mr. John Murray, London, for the use of the blocks for Figs. 21, 22, and 27; the Executive Committee of the Society of Antiquaries, London, for allowing us to make *clichés* from the blocks from *Archæologia*, LV., for Figs. 5, 17, 23, 24, and 31, and to Professor T. M'Kenny Hughes, M.A., F.R.S., &c., for his kind offices in our behalf in this connection; the Council of the Royal Irish Academy, for permission to make *clichés* from the blocks for Figs. 28, 29, and 30 from the *Proc. Roy. Irish Acad.*, VII., 1857-61; the *Wagner'schen Universitäts* Library, Innsbrück, for the use of the blocks for Figs. 20 and 32 from Otto Keller's *Thiere des classischen alterthums in Culturgeschichtlicher Beziehung*.—Hon. Ed.]

Reports on Excursions.

LENNOX CASTLE, 11th September, 1897.—In pleasant weather, on the afternoon of this date, Lennox Castle Gardens and Grounds were visited. There was a good attendance. The extensive collections of herbaceous and greenhouse plants were seen to advantage, and were much admired. The following list of fungi observed is supplied by Mr. William Stewart:—

Agaricus (Amanita) rubescens, Pers.
A. (Amanita) vaginatus, Bull.
A. (Amanita) vaginatus, var. fulvus, Schæff.
A. (Lepiota) granulosus, Batsch.
A. (Armillaria) melleus, Fl. Dan.
A. (Clytocybe) laccatus, Scop.
A. (Clytocybe) laccatus, var. amethystinus, Bott.
A. (Inocybe) rimosus, Bull.
A. (Inocybe) geophyllus, Sow.
A. (Hebeloma) mesophæus, Fr. Uncommon.
A. (Flammula) alnicola, Fr. Uncommon.
A. (Flammula) scambus, Fr. Uncommon.
Coprinus atramentarius, Fr.
Cortinarius cinnamomeus, Fr.
Lactarius insulsus, Fr.
L. blennius, Fr.
L. quietus, Fr.
L. picinus, Fr. Rare.
Russula nigricans, Fr.
R. adusta, Fr.
R. cyanoxantha, Fr.
R. fœtus, Fr.
R. fellea, Fr.
R. emetica, Fr.
R. fragilis, Fr.
R. alutacea, Fr.

Cantharellus cibarius, Fr.
Boletus flavus, With.
B. subtomentosus, Linn.
B. edulis, Bull.
B. luridus, Schæff.
Polyporus giganteus, Fr.
P. adiposus, B. & Br.
P. versicolor, Fr.
Stereum hirsutum, Fr.
S. rugosum, Fr.

Mr. A. Sweet acted as conductor.

Callander, 27th September, 1897 (Glasgow Autumn Holiday) —On this date a small party, conducted by the President (Mr. Robert Kidston, F.R.S.E., F.G.S.), visited Callander. On arrival the party walked to Strathyre, but little of special interest was seen. One object the excursionists had in view was to re-discover the station for *Pilularia globulifera*, Linn., which had been found on the shore of Loch Lubnaig about thirty years before by Messrs. Richard M'Kay and George Horn, but in this the party was unsuccessful. It was too late in the year for flowering plants to be in good condition, and the only one collected, worthy of mention, was *Galium boreale*, Linn., which was found at the Falls of Leny. On previous excursions, the President states, *Hieracium auratum*, Fries, and *H. boreale*, Fries, had been found between Leny and Strathyre; and in Loch Lubnaig, *Utricularia vulgaris*, Linn.

Parallel Roads of Glen Roy, 11th April, 1898 (Glasgow Spring Holiday).—Conjointly with the Geological Society of Glasgow, some of the members of our Society proceeded to Roy Bridge, on this date, to see the Parallel Roads of Glen Roy. On leaving the station the party walked up Glen Roy for about three miles. Some distance up a curious line is observed on the steep hillside, and soon afterwards traces of other two at higher levels

appear. Later on, at a turn in the road, a wonderful sight comes into view. To use in part the words of Sir Archibald Geikie, and subsequently some ideas from Mr. Jamieson, of Ellon—"Before us lies the long deep glen," bounded by bare hills, rising on one side to over 1,400 feet and on the other to over 2,000 feet above it. Along the declivities on each side run three peculiar bars, perfectly horizontal, "straight and distinct as if drawn with a ruler, yet winding into all the recesses of the steep slopes, and coming out again over the projecting parts without ever deviating from their parallelism." The scene is impressive: there seems something mysterious in these peculiar bars, something too mathematically exact to be the work of nature. One does not wonder that a tradition existed among the older inhabitants of this district that these roads were made by Fingal as hunting roads for chasing the deer. In support of this it is stated that in the neighbourhood are the hills of Fingal, of Gaul, of Bran, and of Diarmid. Another tradition is that they were made for this purpose by the kings of Scotland, when Inverlochy Castle, near Fort-William, was a royal residence.

The geologist's explanation is quite as wonderful. The roads are narrow shelves or terraces, about 40 to 50 feet wide, sloping gently to the valley at a lower angle than the steep hillside. So level are they, that it was not till the Ordnance Surveyors had carried a line of spirit-levelling along them that it was discovered that the height varied a little. The heights are—

		Highest. Feet.	Lowest. Feet.	Average. Feet.	Col. Feet.
I.,	-	1,155	1,144	1,148	1,151
II.,	-	1,077	1,062	1,067	1,075
III.,	-	862	850	855	848

From the continuous, horizontal, and parallel character of the shelving roads, it is evident that they have been formed by the action of water, but whether on the shores of the sea or of lakes has been much discussed; and if of lakes, what was the barrier that dammed back the water? The theory that has met with the greatest acceptance is that they were formed during the glacial period on the shores of lakes that were dammed back by glaciers. During that period of intense cold, the Ben Nevis

range of mountains, the highest in the country, was, like all the other Highland hills, a vast feeding-ground for very large glaciers. From the peculiar physiographical conditions of the district, an immense accumulation of ice took place in Glen Spean and in the Great Glen. During the coldest period the pressure from the south and west was so great as actually to force the ice up Glen Roy into Strath Spey, and so seaward. As the climate moderated, a lake was formed in Glen Roy, but, as all southern outlets were blocked by glaciers, the water could only escape at the head of the valley, over the col, or dividing ridge, into Strath Spey. The height of the col is 1,151 feet, while the uppermost road is 1,155 feet at highest and 1,148 feet at lowest. When the ice had further diminished in Glen Spean, so as to leave free the col between Glen Glaster (a side valley to Glen Roy), and the valley of the Rough Burn, a tributary of the Spean, the water found an outlet in this direction, and the second road was formed at a height of 1,077 feet at highest and 1,062 feet at lowest, that of the col being 1,075 feet. The ice continued to shrink until Glen Spean was nearly free, but the higher valleys and the Great Glen were still full of it. The lake now occupied Glen Roy and Glen Spean, escaping at the head of the latter through the pass of Makoul into Strath Mashie, and thence into Strath Spey. The height of this col is 848 feet; of the lowest road in Glen Roy, and the only one in Glen Spean, 862 feet at its highest and 850 feet at its lowest.

With the further amelioration of the climate the ice gradually disappeared, and the drainage assumed its present flow.

Survivals of the plant life of these arctic conditions are to be found plentifully on the high hills to the south of Glen Spean, but we saw none except *Saxifraga aizoides*, Linn. Other plants observed were—*Asplenium viride*, Huds., *Fissidens adiantoides*, Hedw., *Hylocomium triquetrum*, B. & S., *Hylocomium splendens*, B. & S.

At Keppoch, an ancient seat of the MacDonalds, or MacDonnells, of Keppoch, at the confluence of the Roy and the Spean, are some fine trees. Two Larches were measured, and found to have a girth of 13 feet 7 inches at 6 feet 7 inches, and 12 feet 8 inches at 5 feet respectively. These are the largest trees of their kind yet seen at any of our excursions.

Bothwell Castle, 23rd April, 1898.—On the afternoon of this date a party, numbering about thirty, visited the policies at Bothwell Castle. On the walls of the old castle and in its vicinity most of the plants associated with the place were noted, including *Parietaria officinalis*, Linn., *Cheiranthus Cheiri*, Linn., *Malva rotundifolia*, Linn., *Arum maculatum*, Linn., *Clematis Vitalba*, Linn., *Aristolochia Sipho*, L. Hérit., *Ruscus aculeatus*, Linn., *Convallaria majalis*, Linn., *Linaria Cymbalaria*, Mill., *Lepidium latifolium*, Linn. A Beech near the old castle measured 12 feet 4 inches in circumference of trunk at 6 feet from the ground; a Great Maple (variegated) 8 feet 8½ inches at 4 feet; and an Oak, near the modern mansion, 13 feet 9 inches at 3 feet 4 inches. A pair of Kingfishers (*Alcedo ispida*, Linn.) was seen on the Clyde. The weather was, unfortunately, somewhat disagreeable. Mr. John Cairns, Jun., acted as conductor.

Cadzow Forest, 7th May, 1898.—The excursion to Cadzow on the afternoon of this date was favoured with good weather, and there was a large turn-out of members and friends. Mr. James Murray acted as conductor, and the company had the advantage of being accompanied by the head keeper, Mr. David Milne, who obligingly gave much information regarding the White Cattle and the wild life of the district. The herd of cattle at the time of our visit was made up as follows:—

8	Bulls	
2	Queys	
18	Cows	
9	Calves	The whole produce of this season, and all white except one, which was black.
37		
4	Cows	Brought in this season from Vaynol Park (Assheton-Smith's herd) all one-year-olds.
1	Bull	
Total, 42		

From Photograph by *John Fleming.*

Cadzow Forest [Pl. VIII.] contains the most interesting remnant of the old forest-lands now to be seen in Scotland. All the trees show signs of decay, and the visitor, when he first sees them, cannot fail to be greatly impressed with the appearance of decrepitude everywhere visible. But the blasted appearance of these sylvan giants is not incompatible with a vigorous old age. Naismith of Drumloch wrote of them more than a century since that they were very much decayed, and no more can be said about them to-day. The language employed by Lockhart to describe them in "Peter's Letters to his Kinsfolk" in 1819, is still strictly applicable to them :—"The most venerable trees, without question, that can be imagined—hoary and crumbling, and shattered everywhere with the winds and storms of centuries, rifted and blasted in their main boughs, but still projecting here and there some little tufts of faint verdure, and still making a gallant show together where their grey brotherhood crowns the whole summit of the hill—these are

'the huge oaks of Evandale,
Whose limbs a thousand years have worn.'"

A glance at the accompanying plate will give a fair idea of the size which these trees attain, and the portion of the forest represented may be reasonably considered typical of the whole. Probably none of the trees much exceeds in size one measured on the occasion of the Society's visit. The tree referred to was 21 feet 8½ inches in girth of trunk at 5 feet, with a bole of 25 feet, and a spread of branches the diameter of which was 89 feet.

In the Bull Park, *Lathyrus macrorrhizus*, Wimm., was fairly plentiful. After a leisurely inspection of the remarkable Oaks and the Cattle, the party proceeded to the ruins of Cadzow Castle, where a Kestrel (*Falco tinnunculus*, Linn.) was seen, and *Ribes alpinum*, Linn., was found in its old station. The Avon was afterwards crossed and Chatelherault visited. On the walls here, and on the banks beneath them, some naturalized plants and others uncommon in this district may be seen, including *Anchusa sempervirens*, Linn., *Linaria Cymbalaria*, Mill., *Lamium maculatum*, Linn., *Cystopteris fragilis*, Bernh., *Asplenium Ruta-muraria*, Linn. Within the walls are the formal gardens, containing many plants worthy of attention and

boasting an unrivalled turf, while within the *chateau*, which the party was privileged to visit, were many trophies of the chase, chiefly illustrating the wild life of the vicinity. On the return journey to Barncluith gate, the Wood-Wren (*Phylloscopus sibilatrix* (Bechst.)) was found to be not uncommon. Some of the party returned by the right bank of the stream, crossing the picturesque old Avon Bridge after leaving the grounds.

Kelburne Castle, Fairlie, 28th May, 1898.—Although only seven members attended this excursion, the few who were present seemed to enjoy themselves thoroughly amid bright sunshine, foliage of freshest green, and wealth of summer-flowers. Mr. D. A. Boyd acted as conductor.

Several interesting plants were observed between Fairlie Pier Station and the West Lodge, where the party entered the Kelburne Policies. *Anthyllis Vulneraria*, Linn., grew abundantly on waste ground near the railway; a few specimens of *Cochlearia Armoracia*, Linn., were found on a bank at the roadside; and *Valerianella olitoria*, Poll., occurred profusely at the foot of the wall skirting the Kelburne estate. Many plants of *Listera ovata*, R. Br., were seen on a grassy bank near the carriage-drive; *Linaria Cymbalaria*, Mill., *Asplenium Trichomanes*, Linn., and *Scolopendrium vulgare*, Symons, grew on the garden wall; while a beautiful form of *Saxifraga granulata*, Linn., with double flowers, was naturalized in grassy places under the trees. Some time was pleasantly spent in examining the collection of herbaceous plants in the garden, as well as the shrubs and trees for which Kelburne is famed. Some photographs were taken of the venerable yew-trees, old sun-dials, and other objects of interest, after which the excursion was concluded by a walk from Kelburne to Largs.

The following microfungi were observed:—

Peronospora densa, Rabh.—On *Rhinanthus Crista-galli.*

P. trifoliorum, De Bary.—On *Trifolium pratense.*

Uromyces limonii (DC.) Winter.—Æcidiospores and uredospores on *Armeria* in garden.

U. Alchemillæ (Pers.) Winter. — Uredospores on *Alchemilla vulgaris.*

Puccinia primulæ (DC.) Winter.—Æcidiospores on *Primula vulgaris.*

P. rubigo-vera (DC.) Winter.—Uredospores on various grasses.

P. oblongata (Link) Winter.—Uredospores on *Luzula maxima.*

Protomyces macrosporus, Unger.—On *Ægopodium Podagraria.*

Trochila craterium, Fr.—On dead leaves of *Hedera Helix.*

T. buxi, Capron—On dead leaves of *Buxus sempervirens.*

Diaporthe (Euporthe) pulla, Ntke.—On dead branches of *Hedera Helix.*

Oidium monilioides, Link.—On grass-leaves, producing "mildew."

Botanic Gardens, 7th June, 1898.—About forty members visited the Botanic Gardens, Glasgow, on the evening of this date. Among other plants which attracted attention mention may be made of *Cattleya Mossiæ*, Parker, *Dendrobium crassinode*, Benson & Reichb., *D. suavissimum*, Reichb., the "Trumpet" Honeysuckle (*Lonicera sempervirens*, Linn.) with scarlet flowers, *Hibbertia dentata*, R. Br., the genus just named being confined to Australia and closely allied to Ranunculaceæ, *Euphorbia grandidens*, Haw., *E. canariensis*, Linn., and several other grotesque, leafless species of the Spurge family, with prickly stems branched like a candelabrum. *Phormium tenax*, Forst., *Datura sanguinea*, Ruiz and Pav., and *Eucalyptus amydalina*, Labill., were observed in flower in the Kibble Palace. The following were flowering in the Rock Garden:—*Hieracium villosum*, Jacq., *Mimulus cupreus*, Regel., *M. luteus*, Linn., *Armeria alpina grandiflora*, *Anemone Pulsatilla*, Linn., *A. alpina*, Linn., *Cynoglossum linifolium*, Bové, *Erigeron philadelphicus*, Linn., *Dodecatheon Meadia*, Linn., *Inula glandulosa*, Lam., *Lychnis Flos-Jovis*, Desr., *Aster alpinus*, Linn., *Meum Athamanticum*, Jacq., *Primula japonica*, A. Gray, *P. sikkimensis*, Hook., *Verbascum phœnicium*, Linn., *Potentilla rupestris*, Linn., *Helianthemum mutabile*, Mœnch, *Geum coccineum*, Lindl., *Gunnera scabra* Ruiz and Pav., *Sedum asiaticum*, Spreng., *Valeriana*

alliaricefolia, Vahl. The herbaceous plants were in a rather backward state, owing to the unseasonable weather and the sharp frosts during May.

ARDDARROCH, 11th June, 1898.—Twenty-one members turned out to the excursion arranged for the afternoon of this date to Arddarroch, Loch Long. Mr. P. Ewing, F.L.S., Vice-President, acted as conductor. A good collection of Orchids is one of the attractions of the place, while the fine condition of the foliage in the gardens and grounds was apparent to all those who were present. The party was hospitably entertained by Mrs. White. Near the station at Whistlefield, *Geranium nodosum*, Linn., was seen.

QUEEN'S PARK, 21st June, 1898.—About twenty members of the Society visited Queen's Park on the evening of this date, under the guidance of Messrs. Cruden and M'Iver, of the Staff of the Superintendent of Parks. The evening was pleasantly spent, but nothing calling for special attention was brought under notice. For a notice of the shrubs and trees in this Park, reference may be made to these *Transactions* (Vol. IV., N.S., pp. 366-8).

TULLICH HILL AND BEN REOCH, LOCH LONG, 25th June, 1898. —As on the occasion of the last visit of the Society to this locality, this was a joint-excursion with the Geological Society of Glasgow. By arrangement with the railway company a special stop was made at Glen Douglas "passing-place." Mr. John Renwick acted as conductor. The railway at the head of Glen Douglas is over 500 feet above sea-level, and, although within half-a-mile of the sea at Loch Long, and fully five miles from Loch Lomond, is in the drainage area of the latter loch. Loch Lomond is not visible, and the valley seems shut in by high hills —Tullich Hill, 2,075 feet, to the N.E.; Ben Bhreac, 2,233 feet, to the E.; Doune Hill, 2,409 feet, to the S.E.; Cruach an t'Sithean, 2,244 feet, to the S.

On the western side, or from S.W. round to N., the ridge between Loch Long and the valley almost parallel to it, up which the railway has come, does not rise beyond 928 feet above sea-level. Consideration of these facts suggests that the water in flowing to Loch Lomond has lost its road, an idea apparently supported by the curious course of the northern branch of the Douglas Water. Rising on the north slopes of Tullich Hill, and flowing at first north, it soon veers round circularly till it runs a little south of west, then abruptly turns southward when it reaches the valley parallel to Loch Long, where it shortly again tends farther to the west, but on nearing the deeper hollow of Glen Douglas it circles to the S.E., and meeting the short branch from the south-west, the united stream flows E. and E.S.E. to Loch Lomond. But it is really more likely that the watershed of what is now the drainage area of Loch Lomond once extended to the west of Loch Long, and that the hollow occupied by this arm of the sea is of more recent origin than Glen Douglas.

Mr. Peach, of the Geological Survey, says that an anticlinal axis passes a little to the east of this point, running N.E. and S.W., that the strata between this point and Arrochar are very much altered and twisted, more so than those to the north and to the south, that the main joints in the rocks run north and south, thus determining the direction of the deep northern part of Loch Lomond, and that the dip to the westward of the anticline is toward Loch Long. The directions of the dip and of the joints, combined with the steep slope of the hillside above Loch Long, account for the fissures and slips noticed on our previous visit, and recorded in the report published in these *Transactions*, Vol. IV., N.S., p. 360. The party was informed that observations show that a slow movement of the ground towards the loch is still in progress, to the extent of three-quarters of an inch during the last eighteen months.

From the railway on the hillside above Loch Long splendid views are obtained of the loch and of the hills on the farther side, the principal summits being—The Brack, fully 2,500 feet; Ben an Lochain, 2,955 feet; Ben Arthur, or The Cobbler, 2,891 feet, most picturesque of all; Ben Narnain, 3,036 feet; and Ben Crois, 2,785 feet.

Nothing special falls to be recorded about the plants in the

neighbourhood of the railway-line. Among others, the following were seen:—*Saxifraga aizoides*, Linn., *Pinguicula vulgaris*, Linn., *Gymnadenia conopsea*, R. Br., and *Senecio viscosus*, Linn., the last named having been brought probably in ballast.

A Walnut tree (near the church), and some fine Ash trees, were seen at Arrochar. The largest Ash, opposite one of the hotels, was measured on 9th April last, and found to have a girth of trunk of 15 feet 2 inches at 4 feet from the ground on the upper side. We were then told that, by the terms of the feu or lease of the hotel, the tenant is prohibited from interfering with it. As yet we have not found any Ash tree in the West country that exceeds it in size.

In Arrochar, in the possession of Mr. Lindsay, bootmaker, a young Peregrine Falcon (*Falco peregrinus*, Tunstall), about a month old, was seen. It was got, about a fortnight before, from a nest on a cliff about 100 feet high, called the Eagle's Rock, above Loch Sloy. Another young Falcon was killed by falling from the nest. Mr. Lindsay stated that among the hills in the neighbourhood a Buzzard (*Buteo vulgaris*, Leach) had nested this year, and that six Eagles had been seen. Two had been shot, but four still remained.

Auchincruive, 6th August, 1898.—A small party visited Auchincruive on the afternoon of this date. Mr. John Smith, who acted as conductor, supplied the report which follows:—

"Dolerite, much decomposed, covers a large area in the neighbourhood of Auchincruive. A trap dyke is seen crossing the Ayr Water a short distance above the house. Further up the Water, cliffs of thin-bedded Carboniferous sandstones and shales are seen, with two thin coal seams. An old river-channel has been cut through these strata, and it is now filled with drift. Whether it is an old course of the Ayr, or merely that of a side stream, could not be made out. It appears to be too narrow to have been caused by the Ayr in pre-drift times, cutting *sideways* into the rocks, as the Ayr here makes long curving sweeps. There is no stream within a considerable distance of the old channel at the present time.

We passed down the right bank of the Ayr Water, where beds of rusty gravel, covered by alluvium, are exposed, and river

terraces, often of considerable width, extend on both sides of the river back to the drift, the rounded outlines of the latter being more or less covered with trees.

Near Craigie, the old grassed scours of drift are 30 to 50 feet high, and only at one point was a small patch of Carboniferous strata seen on the edge of the Ayr Water. We had no time left to examine the Craigie policies and gardens, but measured a Spanish Chestnut 11 feet 6 inches at 6 feet from the ground. Near it there are a number of tall Beech trees, but none of them of any great girth of trunk.

After leaving Auchincruive, the only notable plants observed were *Malva moschata*, Linn., and *Cnicus heterophyllus*, Willd., growing at not more than 20 feet above sea-level, which is the lowest position I have seen it at. Half-a-mile above Ayr, on the left bank of the river, the Soap-wort, *Saponaria officinalis*, Linn., is abundant."

At Auchincruive the following measurements of interesting trees were taken :—(1) *Robinia Pseud-acacia*, 7 feet 6½ inches in girth of trunk at 3 feet from the ground ; (2) *Araucaria imbricata*, Pav., 4 feet 7½ inches at 5 feet; (3) *Liriodendron tulipifera*, Linn., 7 feet 2½ inches at 3 feet 6 inches ; (4) *Ginkgo* (*Salisburia*) *biloba*, Linn., 3 feet 8½ inches at 4 feet ; (5) Walnut, 11 feet 7 inches at 3 feet 2 inches.

Stonebyres, 13th August, 1898.—Fifteen members and friends visited Stonebyres Estate on the afternoon of this date, in charming weather. There is a small herd of Fallow-deer (*Cervus dama*, Linn.) in a park here, numbering about forty head. They are said to have been introduced about twenty-five years since. In the deer park are some large trees, two Oaks being conspicuous for size. The one nearest the mansion house measured 21 feet 9 inches in circumference of trunk at 3 feet 10 inches from the ground, while the other, which is a more handsome tree, and is to the north of the last, measured 21 feet 1 inch at 3 feet 3 inches. Leaving the deer park, the party proceeded to the gardens. Here a large Walnut tree (*Juglans regia*, Linn.), the trunk of which had a girth of 13 feet 9 inches at 3 feet 3 inches, attracted attention. Although its symmetry is somewhat destroyed, owing to the loss of a large limb, it still remains a handsome tree. The gardens

and vineries were examined with interest, the display of Tuberous Begonias in one of the greenhouses exciting general admiration.

Through the kindness of the tenant of Stonebyres, the Hon. A. Y. Bingham, tea was served, and the party had an opportunity of seeing the public rooms. The house itself is very interesting, the walls of the old portion, which is said to date from 1289, being of great thickness. Stonebyres Fall, on the Clyde, was then visited. Plants noted here worthy of mention were *Vicia sylvatica*, Linn., *Milium effusum*, Linn., and *Poa nemoralis*, Linn. Mr. Robert M. Morton acted as conductor.

Rossdhu, 27th August, 1898.—On the afternoon of this date, in very unfavourable weather, fifteen members (conducted by Mr. R. D. Wilkie) visited Rossdhu, Luss, the estate of Sir James Colquhoun, Bart. The weather prevented much scientific work being done.

Many fine examples of Oak, Ash, Great Maple, Silver Fir, and Scotch Fir were noticed. A hurried visit was paid to the hot-houses and gardens, the party being much interested in seeing a fine fruiting specimen of *Monstera deliciosa*, a Mexican aroid, the fruit of which is edible. Its large leaves are perforated in a very curious manner. A number of Pine Apples in fruit also attracted attention.

Throughout the afternoon there were no phænogams worthy of mention collected. In cryptogams the very rare moss *Habrodon Notarisii*, Schp., was found growing luxuriantly upon the trunk of a large Great Maple, and *Tortula papillosa*, Wils., a moss of very local distribution, rare in Clydesdale, was found upon the trunks of three Great Maples and an Elm.

The following trees were measured:—Wych Elm, at Luss Hotel, 13 feet 6½ inches at 5 feet 4 inches; Silver Fir, Camstradden Bay, west side of the road, 17 feet 1½ inches at 6 feet on lower side, said to be 117 feet high; Silver Fir, Camstradden Bay, east side of the road, 13 feet 7 inches at 6 feet on lower side, said to be 120 feet high. Tulip tree at Rossdhu House, 5 feet 7 inches at 3 feet 10 inches.

In the deer park there was seen a considerable herd of Fallow-deer (*Cervus dama*, Linn.) and some Red Deer (*Cervus elaphus*, Linn.).

Proceedings of the Society.

SESSION 1897-98.

28TH SEPTEMBER, 1897.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

Reports were read on excursions to Halkshill Glen (see page 127), Lennox Castle (see page 274), and Callander (see page 275).

Mr. Wm. Stewart read a report on the Annual Conference of the Cryptogamic Society of Scotland, which was held this year at Kilmarnock. The meeting was a very successful one, and the localities visited yielded many fungi of interest. On the first day, at Barskimming and Stair, the following species of fungi were noted among many others:—*Agaricus virosus*, Fr., *A. phalloides*, Fr., *A. virgatus*, Fr., *A. fumosus*, Pers., *A. pyrotrichus*, Holmsk., *Phallus caninus*, Huds., *Libertella faginea*, Desm., and *Protomyces pachydermus*, Thümen. The most notable fungi observed at the excursion to Sorn Castle were:—*Agaricus sericellus*, Fr., *A. tuberosus*, Bull., *Nyctalis parasitica*, Fr., *Lactarius camphoratus*, Fr., and *Cantharellus tubæformis*, Fr. Among those found at Loudoun Castle may be mentioned—*Agaricus gracilis*, Br., *A. hæmatopus*, Pers., *A. fibula*, Bull., *A. fragrans*, Sow., *A. crustuliniformis*, Bull. (the small variety), *A. hæmactus*, Berk. & Cke., *A. pantherinus*, DC., *Lactarius pallidus*, Fr., *L. fuliginosus*, Fr., *Craterellus sinuosus*, Fr., *Clavaria cristata*, Pers., *C. cinerea*, Bull., *Polyporus ferruginosus*, Fr., and *P. cæsius*, Fr.

Mr. George Murdoch, B.A., B.Sc., 6 Ruthven Street, Hillhead, was elected as an Ordinary Member.

A collection of plants from the Swiss Alps was exhibited by Mr. Robert Brown, M.D., including *Papaver alpinum*, Linn., *Anemone alpina*, Linn., *Pinguicula flavescens*, Fl., *Lychnis Flos-Jovis*, Desr., *Hutchinsia brevicaulis*, Hoppe, *Primula integrifolia*, Linn., and *Ranunculus alpestris*, Linn.

Mr. L. Watt sent for exhibition specimens of *Vaccinium Vitis-Idæa* in flower, an unusual circumstance at this season.

Mr. D. A. Boyd sent to be read on his behalf, "Additional Notes on the Peronosporeæ and Ustilagineæ of North Ayrshire" (see page 161); and another paper entitled "Micro-fungi observed near Kilmarnock, Ayrshire" (see page 159).

Mr. George W. Ord read a paper entitled "Notes on the Tipulidæ of the Glasgow District." (See page 190.)

Mr. G. F. Scott Elliot, M.A., B.Sc., F.L.S., F.R.G.S., read a paper on "Sugar-cane Culture in Australia," the subject being illustrated by a series of lantern-slides.

The President (Mr. Kidston) showed, with the lantern, a series of micro-photographs, comprising preparations of insects, vegetable and fossil sections, and diatoms.

26TH OCTOBER, 1897.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

REPORT OF THE COUNCIL (1896-97).

Membership.—During the past year 42 Ordinary Members were added to the roll; the present membership being as follows:—

Honorary Members, - - - - -			14
Corresponding Members, - - - -			39
Ordinary Members (Life), - - -	32		
(Annual Subscriptions), - -	234		
		——	266
Total, - - - -			319

This statement shows an increase of 26 Members over last year.

Associates.—The number on the roll is 25.

Obituary.—The obituary record includes the names of Professor Thomas King, Dr. David Robertson, Professor Henry Drummond, Messrs. Alexander Mitchell, Henry Boswell, C. O. Sonntag, Adam Knox, and Norman D. Napier.

Excursions.—Fourteen excursions took place during the session. Unless on three occasions the attendances were poor.

British Association.—The Society continues to be enrolled on the List of Corresponding Societies of this Association. Mr.

Edward E. Prince, B.A., F.L.S., Director of Fisheries, Dominion of Canada, was the Society's delegate at the meeting at Toronto.

Library.—The Hon. Librarian (Mr. James Mitchell) reported that his records for the year showed that the books in the Library had been borrowed more frequently during the past year than in any year since its formation in 1861. The additions included 150 volumes forming the Botanical Library of the late President (Professor King), other 10 vols. presented by various well-wishers, and 15 vols. purchased.

Finance.—The Hon. Treasurer (Mr. John Renwick) submitted his Annual Statement of Accounts, duly audited. This statement showed a balance in the Society's Ordinary Fund of £90 10s. 6½d., and in the Life Members' Fund of £147. From the Ordinary Fund balance there falls to be deducted the cost of publishing *Transactions* till 31st August, 1897. (See page 304.)

Transactions.—The Hon. Editor (Mr. John Paterson) reported that in March a part of the *Transactions* was issued covering a period of sixteen months, and bringing the publications of the Society to a point at 31st August, 1896. The part of *Transactions* for the past year ending 31st August, 1897, was reported to be in the press, and was intended to be in the hands of the Members before the end of the year (1897).

The Reports were all unanimously approved of and adopted.

Vacancies in the Council were then filled up by the election of the following gentlemen:—Mr. Alexander Somerville, B.Sc., F.L.S., as Vice-President; Messrs. Hugh Boyd Watt, G. F. Scott Elliot, M.A., B.Sc., F.L.S., F.R.G.S., David Pearson, and Charles Hogg were elected Members of Council for three years, and Mr. George W. Ord for one year.

Messrs. James Jack and William Leighton were re-elected Auditors.

Mr. Thomas Pairman, 54 Gordon Street, was elected as an Ordinary Member.

Mr. John Paterson exhibited an example of Sabine's Gull (*Xema sabinii* (J. Sabine)), in immature plumage, which he had received from Sliddery, Arran, through the kindness of Dr. Fullarton, Lamlash. This is the first record, with proof, of the occurrence of this Arctic species in the Clyde area.

On behalf of Mr. Henry M'Culloch, Mr. Paterson also exhibited

an albino Starling (*Sturnus vulgaris*, Linn.), the first albino of this species which had come under Mr. M'Culloch's notice during his long experience.

Mr. Peter Ewing, F.L.S., Vice-President, exhibited some plants collected in Cornwall this year.

An Alga sent by Mr. Thomas Binnie, Jun., from Lower Kildonan Loch, South Uist, was exhibited and described by Mr. R. D. Wilkie. The identification of the plant as *Cladophora ægagropila*, Linn., was confirmed by Mr. M. C. Cooke, A.L.S. Cladophora is a genus of green algae of wide distribution, occurring in both salt and fresh water. The body of the plant is filamentous, more or less variously branched, and, in its early stages at least, is attached to the substratum by a basal root-like process. The filaments are septate, each segment containing a dense peripheral layer of small polygonal plates, the chloroplastids, in which may be seen numerous starch granules, and some highly refractive globular bodies termed the pyrenoids. Each segment contains a number of nuclei, so that it must be regarded from a morphological standpoint as being multicellular. Reproduction is both asexual and sexual. In the former case the contents of a segment, which does not in any way appear to be differentiated from adjacent segments, break up into a number of ciliated masses, which, upon being liberated by the rupture of the cell-wall, swim actively about in the water for a short time, after the expiry of which they fix themselves to the substratum, and bud out into a new plant. Another method of propagation is by the breaking up of the filament into its individual segments, each one of which by apical growth develops into a new filament. Sexual reproduction is by means of ciliated cells which swim about and conjugate, the result of the union being a spore which, upon germination, produces the plant. The sporophyte generation is thus seen to be absent.

The chief interest attaching to this species is its habit of forming large spheroidal masses on the bottoms of the lochs in which it occurs. The explanation appears to be as follows:— When the plant germinates, it is attached to the bottom by the root segment. During growth the filaments branch from centres in every direction, forming, in process of time, a densely felted mass, the meshes of which become infiltrated with fine mud.

Breaking away from its point of attachment, any current in the waters of the loch would tend to roll the mass about, and by thus causing each part of its surface in turn to be acted upon with tolerable uniformity by the light, varying both in direction and intensity and by contact with the bottom, existing inequalities in the surface would come to be averaged, and the figure approximate to that of a sphere as in the specimen exhibited.

Mr. Wilkie stated that, in a shallow bay in a disused clay-hole in the vicinity of the city, he had often observed loosely agglomerated spheres of the size of a marble formed in this manner by an allied species which does not branch so freely in a radial direction as does *Cladophora ægagropila*, Linn.

Specimens of the genus Barbula, as constituted by Dr. Braithwaite, and *Dicranum capnodes*, Stirton, a new moss from Ben Vorlich, Loch Lomond, were exhibited by Mr. James Stirton, M.D., F.F.P.S.G.

Mr. R. D. Wilkie exhibited a young Lizard belonging to the order Gekonidæ, which had been captured in the warehouse of Messrs. John MacLeish & Co. in this city.

Mr. Charles Kirk showed a number of photographs of birds' nests taken on Ailsa Craig.

Mr. S. M. Wellwood read a paper entitled "Observations on some Morphological Abnormalities in the Tomato," and illustrated his paper by specimens of the plants and diagrams. (See page 181.)

Mr. J. Ballantyne read a paper entitled "Occurrence of *Sirex gigas*, Linn., in Bute and Arran." (See page 187.)

30TH NOVEMBER, 1897.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

Mr. William H. Lang, M.B., C.M., B.Sc., 40 Laurence Street, Dowanhill, was elected as an Ordinary Member, and Mr. Peter Goodfellow, 2 Alexandra Parade Gardens, was admitted as an Associate.

The Hon. Editor (Mr. John Paterson) laid on the table Vol. V., Part I. (New Series), of the *Transactions and Proceedings* of the Society, bringing the records to a point at 31st August last (Session XLVI.).

The Rev. G. A. Frank Knight, M.A., Convener of the Museum and Research Committee, drew attention to the fact that the British Association for the Advancement of Science was to meet in Glasgow in 1901. He urged the importance of setting to work at once to prepare lists of the Fauna and Flora of the district, and he asked the members of the Society to co-operate with the Museum and Research Committee in the projected work.

Mr. R. S. Wishart, M.A., exhibited some common Oak-Galls.

Mr. Charles Kirk exhibited a hybrid between the Black Grouse (*Tetrao tetrix*, Linn.) and the Capercaillie (*Tetrao urogallus*, Linn.) from Perthshire.

On behalf of Professor T. K. Dalziel, M.B., C.M., Mr. John Paterson exhibited the Common Moonal Pheasant (*Lophophorus refulgens*, Temm.) from the Himalayas.

Mr. Charles Hogg exhibited specimens of the Stoat and Weasel.

Mr. James Whitton exhibited specimens of the inflorescence of *Yucca gloriosa*, Linn., from Camphill, and stated that, though this plant is popularly believed to flower only once in its lifetime, he had known plants flowering at least twice within his own experience.

Mr. Thomas Scott, F.L.S., read a paper entitled "Notes on the Micro-fauna of Ailsa Craig, Firth of Clyde." (See page 153.)

Professor G. Bell Todd, M.B., C.M., read a paper entitled "Some Eucalypts and their Medicinal Products."

28TH DECEMBER, 1897.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

Messrs. Norman H. W. MacLaren, 5 Belhaven Terrace, and Andrew Sharp, Jun., 211 Great Western Road, were elected as Ordinary Members.

On behalf of Mr. R. S. Houston, Mr. Peter Ewing, F.L.S., exhibited a number of plants collected in Renfrewshire. Among them were—*Trifolium arvense*, Linn., *Veronica scutellata*, Linn., *Ranunculus sceleratus*, Linn., *Senecio viscosus*, Linn., *Neottia Nidus-avis*, Linn.

Mr. Robert Brown, M.D., read a paper on "Alpine (Swiss) Gentians." He referred to the Gentianaceæ as an order attractive to the general lover of nature by its extreme beauty of colour,

which is specially marked in the Gentians, and to the Alpine botanist by the frequency with which he meets it, in varied form, in all districts in the higher ranges of mountain work. The Alpine Gentians vary much in size and colour, some being three or four feet in height, while others are so minute as to be only noticeable by the bright-blue colour peeping through the grass of the pasture-slopes. The situation in which they are found is from 3,000 feet high to the edges of the snow-fields; on the level meadows of the mountains, sometimes in the marsh, but more frequently on the comparatively dry parts; on the steep mountain sides, amongst the short grass, and on the ledges of rocks where little beds of soil have accumulated; but, most of all, where the melting snow trickles down amidst the soft rocky detritus, or on the sloping mountain ridges where the soft soil is kept saturated with moisture from the ice-fields.

In most Alpine Gentians the stem is one-flowered, especially in those found in the highest elevations, but to this there are some marked exceptions. In the tall Gentians the plants are many-flowered, and these are either arranged in whorls in the axils of the leaves, or form dense masses at the apex of the stem.

A distinguishing characteristic amongst the Alpine Gentians is the presence or absence of beard-like fringes in the throat of the corolla. Those possessing this bearded throat are small-flowered, the corolla being four or five-cleft, and blue, violet, or lilac in colour. *Gentiana campestris*, Linn., a familiar British plant, is a good example of this class. The beardless or fringeless Gentians are well known through their representative, *G. acaulis*, Linn. This group has large campanulate-shaped flowers, which only open, to be clearly seen, under the direct rays of the sun. Dr. Brown stated that he had been unable to differentiate as distinct in any permanent characters either *G. excisa*, Presl., or *G. Clusii*, Perr. & Song., from their prototype, *G. acaulis*, Linn. He had examined large numbers of plants from different districts, but had entirely failed to satisfy himself as to their being distinct; such variations as exist are inconstant, and no permanency exists in any sufficient degree to justify separation. Dr. Brown further referred to the section whose flowers are rotate with a long tube, in which *G. bavarica* is best known, and to the section in which the corolla may be campanulate or rotate, but all of which possess

an inflated calyx, with more or less broad wings at the angles, *e.g.*, *G. utriculosa*, Linn.

A series of photographs taken in Ceylon by Mr. T. C. Willis, Director of the Royal Botanic Gardens, Peradeniya, was exhibited by Mr. G. F. Scott Elliot, M.A., B.Sc., F.L.S., F.R.G.S. The photographs illustrated the cultivation of tea, coffee, cocoa, cinnamon, &c., and represented the plants under cultivation in the field, and also their various flowers and fruit.

25TH JANUARY, 1898.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

Mr. S. M. Wellwood exhibited a collection of plants from France (*Département du Rhône*)—most of the species included, and some of the genera, not being represented in the British Flora.

Mr. Symers M. Macvicar exhibited the following three hepatics from Moidart, Inverness-shire:—(1) *Lepidozia cupressina* (Sw.), described by Taylor as *L. tumidula*, which is stated in *The London Catalogue of British Mosses and Hepatics*, 2nd ed., 1881, as having been found in the Peninsular Province (Cornwall, &c.) and the Humber Province (Yorkshire), and in Ireland. No. 270 in Carrington and Pearson's *Hepatica Britannica Exsiccata* is a specimen of this plant from near Loch Maree, Ross-shire, gathered by Dr. Carrington in 1889. It is not rare in Moidart, and in Mr. Macvicar's opinion should be found in other parts of the West Coast. It is easily distinguished from *Lepidozia reptans*, Linn., by being erect, very densely tufted, and cream-coloured. (2) *Mastigophora Woodsii* (Hook.), Nees, a very rare plant, first discovered in the south-west of Ireland. In Wallace's *Island Life*, 2nd ed., 1892, it is referred to, on the authority of Mr. Mitten, as being "found in Ireland and the Himalayas, but unknown in any part of Continental Europe." In *The London Catalogue of British Mosses and Hepatics* no English locality is given, but Province 17 is mentioned for Scotland. Whether this refers to 17A, Upper North Highland (Sutherland, Caithness), or to 17B, Lower North Highland (Ross-shire), is left in doubt. Mr. Macvicar found it in Moidart in 1892, and again this year, in some quantity, among wet rocks in a ravine at 1,200 feet altitude; also, but sparingly, at 400 feet altitude. This handsome species grows in large con-

spicuous reddish masses, which could hardly be overlooked. (3) *Herberta adunca* (Dicks.), Gray, which grows in places similar to the preceding and is much like it at a distance, as it also grows in large reddish masses. It is stated (*op. cit.*) to occur in the North Welsh, Lake, East and West Highland Provinces, and in Ireland. It is rather common in Moidart, and is probably to be found in many parts of the West Coast.

Mr. Anderson Fergusson exhibited the following Coleoptera from Ailsa Craig:—*Silpha thoracica*, Linn., *Pyrrhus pilula*, Linn., *Coccinella septempunctata*, Linn., *Otiorhynchus blandus*, Gyll., *O. rugifrons*, Gyll.

Rev. A. S. Wilson, M.A., B.Sc., read a paper entitled "Self Irrigation in Plants, with Remarks on Animals inhabiting the Axils of Leaves."*

A paper entitled "Past Distribution, Present Migration, and Dispersal of Species in Scotland," by Mr. J. A. Harvie-Brown, F.R.S.E., F.Z.S., M.B.O.U., was read. The author referred to the former land-connections of Great Britain as urged by geologists, and the evidence of organic remains, as tending to show and prove the same. Dispersals are going on at the present time under the observation of ornithologists along certain lines of advance, but a much longer series of observations than is at present available will be required before absolute certainty can be reached regarding the past and present dispersal of species. Reference was made to the case of the Capercaillie which has been separately worked out in detail in Mr. Harvie-Brown's *The Capercaillie in Scotland* (Edin., 1879). This bird, having been restored from a Continental source, cannot be held to be dependent for any extension of its range here, on an annual migration of its kind. While the Capercaillie had been extinct in this country, the Squirrel, which was next referred to, is not believed to have been utterly exterminated, although it had nearly shared the Capercaillie's fate. Unlike the Capercaillie, the Squirrel, having been reintroduced in a *number* of localities, elements of difficulty enter into the study of its dispersal, but these have been dealt with in a previous essay by Mr. Harvie-Brown on *The History of the Squirrel in Great Britain* (Edin. 1881). The Crested Titmouse was then referred

*In *Knowledge*, Vol. XXI., 1898, this paper is printed in another form.

to as a species dependent for any future extension entirely upon its increase at a single centre (the pine-forests of Rothiemurchus), and quite independent of any accessions by migration. Another class of illustrations was then brought forward relating to species which have greatly increased under our own eyes. From being regular birds of passage, these have invaded our northern areas, apparently from different centres, ever increasing and pushing forward. The Stock-Dove, Tufted Duck, Great Spotted Woodpecker, Hawfinch, Redstart, Starling, Goosander, and Red-breasted Merganser were cited as examples. A point deserving further attention is, that extension of range of species as breeding species in Britain does not depend upon the autumnal lines of migrations, but upon the returning lines of spring migrations. Another species which of late years has bred numerously in Scotland—the Woodcock—was stated to have extended its breeding area recently into the bleak, unwooded islands of the Outer Hebrides. This, however, was not done apparently until the more sheltered birch-clad glens and young fir and larch-plantations of the mainland had received and cherished the earlier colonists of the species. In conclusion, Mr. Harvie-Brown in his paper appealed to naturalists to pay close attention to detail in recording the movements of all living things, as important results might be reached even from what might appear of little importance at the time.

22ND FEBRUARY, 1898.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair

Messrs. Andrew Adie Dalglish, 21 Prince's Street, Pollokshields; James F. Gemmill, M.A., M.B., C.M., 16 Dargarvel Avenue, Dumbreck; James Johnman, 4 M'Kechnie Street; James Lockie, 25 Iona Place, Mount Florida; and R. Hedger Wallace, 7 Great Kelvin Terrace, were elected as Ordinary Members.

Mr. George Horn exhibited a collection of Alpine plants from the Andes. Among them were *Luzula Alopecurus*, Desv., *Azorella aretioides*, Willd., *Cerastium imbricatum*, H.B. & K., and species of Valeriana and Alchemilla from the snow-limit; also *Astragalus uniflorus*, DC., gathered on Chimborazo, at an altitude of 15,000 feet. Mr. Horn also showed a specimen of *Menziesia cærulea*, Wahlenb., from the Sow of Atholl.

Professor Malcolm Laurie, D.Sc., B.A., F.L.S., F.R.S.E., read some notes on "The Embryos of some Scorpions and their Allies."

A paper entitled "Note on Raspberry Roots" by Mr. G. F. Scott Elliot, M.A., B.Sc., F.L.S., F.R.G.S. and Mrs. Fingland was read (see page 205); and Mr. Scott Elliot read further a "Note on China Grass" (see page 179).

Mr. Robert Dunlop showed on the screen a series of photographs of birds' nests.

29TH MARCH, 1898.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

The Society met on the evening of this date at an early hour. There was first exhibited an extensive series of marine objects and microscopic preparations, provided by Professor W. C. M'Intosh, M.A., LL.D., F.R.S., F.R.S.E., F.L.S., C.M.Z.S., Corresponding Member; and thereafter, in the large hall, which was quite filled, Professor M'Intosh delivered a lecture on "The Influence of Man on the Inhabitants of the Ocean." Mr. A. Somerville, B.Sc., F.L.S., Vice-President, occupied the chair at the lecture, which was closely followed by the large audience present. The lecture was illustrated by a series of coloured drawings and lantern slides.

26TH APRIL, 1898.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

Reports on excursions to Glen Roy (see page 275) and Bothwell Castle (see page 278) were read.

Reference was made to the loss which the Society had sustained in the death of Sir James Bain, who had been a member of the Society for thirty-six years.

Mr. C. J. Robertson, Rannoch, Cambuslang, was elected as an Ordinary Member.

Mr. Johnstone Macfie, M.D., exhibited a supposed hybrid between the Black Grouse (*Tetrao tetrix*, Linn.) and the Red Grouse (*Lagopus scoticus*, Lath.). This bird had been recently shown to the Zoological Society of London, where two opinions had been expressed—(1) that it was an old Grey-hen assuming male plumage, and (2) that it was a hybrid as hinted above. The

latter opinion was stated to be held by Mr. Bisshopp, taxidermist, Oban, who had dissected it (without succeeding in determining its sex), and Mr. W. Eagle Clarke. The head of this bird is like that of a clumsily-headed Grouse; its shape is neither that of the Grey-hen nor Black-cock. From the root of the upper mandible on each side there is a horn-like projection, quarter of an inch in length. The legs are feathered, but not the toes. The tail approaches in appearance to that of the Black-cock, the outer feathers being recurved, and lower tail-coverts white.

Mr. James Whitton exhibited a collection of Himalayan Rhododendrons and other plants in flower from Stonefield, Tarbert. Some of the Rhododendrons shown were new to cultivation, and had flowered for the first time this year, although long established.

Mr. R. Hedger Wallace read a paper on "White Cattle: an Inquiry into their Origin and History." (See page 220.)

A paper entitled "Meteorological Notes and Remarks upon the Weather during the Year 1897, with its General Effects upon Vegetation," by Mr. James Whitton, Superintendent of Parks, Glasgow, was held as read. (See page 163.)

Another paper, by Messrs. R. D. Wilkie and James Murray, entitled "The Mosses of Campsie Glen: a Contribution towards a List of Mosses of the West of Scotland," was also held as read. (See page 217.)

A paper on "Glasgow District Plant Associations," by Mr. G. F. Scott Elliot, M.A., B.Sc., F.L.S., F.R.G.S., was held over for want of time.

Mr. Scott Elliot exhibited some botanical objects under the microscope, and Mr. Robert Dunlop showed, through the lantern, some photographs taken at the Glen Roy excursion.

31st May, 1898.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

Reports were made on excursions to Cadzow Forest (see page 278), Brodick, and Kelburne Castle (see page 280).

Messrs. Mark Thomas Graham, 14 Lorne Terrace, Maryhill, and Charles A. Pulsford, 41 Ashton Terrace, Hillhead, were elected as Ordinary Members.

Mr. S. M. Wellwood (Hon. Secretary), on behalf of the Glasgow Eastern Botanical Society, whose affairs are now wound up, presented to the Society *The Royal Natural History* (Lydekker) and other works, including an edition of Hennedy's *The Clydesdale Flora*, which Mr. James Mitchell (Hon. Librarian), in acknowledging the gift, stated completed the Society's set of all the editions of this standard work on the botany of Clydesdale.

Mr. Peter Ewing, F.L.S., Vice-President, showed a series of Alpine Carices, including *Carex chordorrhiza*, Linn., from a deep sphagnum-bog at Altnaharra, in West Sutherland, growing "in just such places as produce *C. limosa*." Mr. Ewing stated this to be one of the most interesting botanical discoveries in recent years. The plant is very distinct in appearance, he said, and could not readily be passed over as being any other species.

Mr. Ewing also exhibited, on behalf of Mr. Andrew Gilchrist, Darvel, *Juniperus communis*, Linn., from Pogiven Burn, Loudoun, and *Lithospermum arvense*, Linn., and *Scandix Pecten-Veneris*, Linn., from Doonfoot, Alloway.

The Chairman and Col. J. S. Stirling exhibited the following plants from Stirlingshire:—*Sambucus Ebulus*, Linn., *Erigeron canadense*, Linn., *Epilobium roseum*, Schreb., *Salvia Verbenaca*, Linn., *Rumex maritimus*, Linn., *R. sanguineus*, Linn., *Medicago falcata*, Linn., *M. maculata*, Sibth., *Reseda lutea*, Linn., *Carex paludosa*, Good., *Linaria Elatine*, Mill., *Senebiera didyma*, Persoon, *Polycarpon tetraphyllum*, Linn.

Mr. R. D. Wilkie exhibited the Ringed Snake (*Tropidonotus natrix*, Gesn.), and the following mosses, *Grimmia patens*, B. & S., *Fontinalis antipyretica*, Linn., in fruit, and *Hypnum ochraceum*, Turn., from Glengarnock; also *Tortula papillosa*, Wils., from Lee Castle, Braidwood.

Mr. James Mitchell exhibited the Skin of the Silver Jackal (*Canis mesomelas*) from the Orange Free State.

Mr. R. S. Wishart, M.A., read a paper entitled "Notes on two examples of induced abnormal growth in stems—(1) A Scythe-stone embedded in a Beech; (2) Cork-screwing in an Ash."

28TH JUNE, 1898.

Mr. Peter Ewing, F.L.S., Vice-President, in the chair.

Reports were handed in on excursions which had taken place to the Botanic Gardens (see page 281), Arddarroch (see page 282), Queen's Park (see page 282), and Tullich Hill and Ben Reoch (see page 282).

Mr. David Willox, 48 Burgher Street, Parkhead, was elected as an Ordinary Member.

Mr. James Mitchell (Hon. Librarian) intimated a valuable gift to the Society from the Lords Commissioners of Her Majesty's Treasury, consisting of twenty-nine royal quarto volumes and four parts of the report of the scientific results of the voyage of H.M.S. "Challenger" during the years 1872-6. Mr. Wm. Stewart referred to the good offices of Sir John Murray, LL.D., Ph.D., F.R.S., &c., and Mr. A. Somerville, B.Sc., F.L.S., in obtaining this valuable addition to the Library, and moved a vote of thanks to these gentlemen, which was heartily accorded. On the motion of the Rev. G. A. Frank Knight, M.A., a vote of thanks was also heartily given to the Lords Commissioners of Her Majesty's Treasury for the gift.

Mr. Charles Hogg exhibited a Kingfisher (*Alcedo ispida*, Linn.) from Meikleour, Perthshire.

Mr. James Mitchell exhibited a Skin of the Serval Cat (*Felix serval*) from the Orange Free State.

A paper by Messrs. John Paterson and John Renwick, entitled "Report of a Visit to Sanda and Glunimore," was read. (See page 197).

2ND AUGUST, 1898.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

Mr. S. M. Wellwood (Hon. Secretary) intimated the death of, and read an obituary notice on Mr. Joseph Christie, who joined the Society in 1882. It was agreed that the sympathy of the meeting should be conveyed to the widow of the deceased. Joseph Christie was a native of Kilmarnock, and was born in 1838. He received his first lessons in natural history from his father, who was an enthusiastic naturalist. The subject of this notice was almost the last survivor of the old botanists of the East End of Glasgow. Among the Camlachie weavers of forty or fifty years ago there existed a school of botanists and naturalists, with whom Joseph

Christie associated as a boy. He afterwards became the chronicler of some of these worthies in papers contributed to the Glasgow Eastern Botanical Society. His early association with his father in natural history pursuits brought him into contact with local botanists of a generation or two before his own time. Possessed of a good memory, he was enabled, through his early associations, to add to his own experiences the accumulated lore of his predecessors, and to speak of local changes in the topography, flora, and fauna of the Glasgow district with the authority of a centenarian. From an early age he had been accustomed to arduous manual labour. At the time of his death, and for twenty years preceding it, he acted as foreman moulder with Messrs. Kesson & Campbell, of Parkhead. The nature of his duties left him little time for his hobbies, but, with an iron frame and inexhaustible enthusiasm, he was able to devote more time to his favourite pursuits than many men with more leisure.

In addition to being a good field-botanist he was well read in botanical literature, and well informed in many branches of natural science. His genial nature won him many friends. His was one of those rare natures that never grow old, and his extensive knowledge of local lore and everything out of doors, combined with his pawky Scotch humour and endless flow of story and anecdote, made him one of the most delightful companions by summer fields or winter fires. Being of a retiring and modest disposition, he did not come much before the Society, although he was known personally to many of the members. He was present at the excursion to Queen's Park on 21st June, on which occasion he was in the best of spirits, although carrying with him the distressing evidence of recent severe trouble. On the following day what proved to be a fatal seizure took place while he was superintending a casting. He never fully regained consciousness, the end coming on the 8th of July. Joseph Christie was a man apart, and his genial face and well-known figure will be much missed among the field-naturalists of the West of Scotland.

Mr. William Purves, 9 Kelvingrove Street, was elected as an Ordinary Member.

Mr. C. Sherry exhibited some plants from the Botanic Gardens, including *Exacum affine*, Balf.; *Limnobium bogotensis*, Karst., the American Frogbit; *Hypericum chinense*, Linn.; the fruit of the

Granadilla (*Passiflora quadrangularis*, Linn.); *Vanilla aromatica*, an Orchid from Tropical America, easily distinguished from other Orchids by its climbing habit; *Celsia Arcturus*, Jacq.; and *Piper dilatatum*.

On behalf of Miss L. K. Strombom, Mr. Sherry also exhibited a portfolio of water-colour drawings which she had made of wild flowers of the Bahamas. Many of the plants depicted are unknown to cultivation.

Mr. Geo. Russell exhibited, on behalf of Mr. J. B. Mirrlees, a new and handsome greenhouse-plant, *Acalypha Sonderiana*, Muell.

Mr. Russell also showed a pot containing earth from Table Mountain, Cape Town, in which two plants had made their appearance—(1) a species of Drosera, and (2) *Utricularia Ecklonii*, Spreng.

Mr. R. D. Wilkie exhibited a Broom-rape (*Orobanche speciosa*).

Mr. S. M. Wellwood exhibited a number of fresh plants from Mr. Cuthbertson, Rothesay, including *Platycodon grandiflorum*, A.DC.; *Coccoloba vespertillionis*, a New Zealand dwarf deciduous shrub; *Acæna adscendens*, Vahl.; *A. microphylla*, Hook.; and *Mentha Requieni*, a dwarf creeping mint.

Col. J. S. Stirling sent for exhibition *Linaria viscosa*, Dum., from Stirlingshire.

30TH AUGUST, 1898.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

Reports on excursions to Auchincruive (see page 284), Stonebyres (see page 285), and Rossdhu (see page 286) were read.

Mr. James Murray sent for exhibition eggs of the Kingfisher (*Alcedo ispida*, Linn.), taken on 27th July this year from a nest on the banks of the Nith, near Drumlanrig. Mr. Murray had been informed that it is only in recent years that this species has been seen on this part of the Nith.

Mr. W. Stewart exhibited *Sirex gigas*, Linn., from Glen Rosa, Arran.

Mr. Richard M'Kay exhibited *Pilularia globulifera*, Linn., from Lochend Loch. It had been rediscovered recently in that locality in great abundance by the Rev. R. G. Waddell.

Mr. C. Sherry exhibited the Water Caltrops (*Trapa natans*, Linn.) from Glasnevin Botanic Gardens. The curious four-horned fruits of this species have been compared to the spiked iron instruments called Caltrops, formerly employed in warfare to impede the progress of cavalry. Mr. Sherry also showed *Trapa bicornis*, Linn., the Ling of the Chinese, which is often sold in our streets as a curiosity. The fruit in this species resembles a bull's head. Mr. Sherry further exhibited *Talisia guianensis*, Aubl., which is interesting on account of its being the only one of the eighteen species in the genus Talisia which has been introduced to cultivation.

Mr. G. F. Scott Elliot, M.A., B.Sc., F.L.S., F.R.G.S., read a paper entitled "Limits to the Range of Plant Species." (See page 208.)

1896.—Sept. 1.						
To Balance—Life Members' Fund,		£41	15	0		
Ordinary Fund,						
on loan,	£40 0 0					
Do., in Bank,	70 0 0					
	£110 0 0					
Less due to Treasurer,	12 13 6½					
	97 6 5½				£139	1 5½
1897.—Aug. 31.						
To 1 Life Member's Subscription,					5	5 0
,, 231 Members' Annual Subscriptions, @ 7s. 6d.,					86	12 6
,, 1 Member's Arrears,					0	7 6
,, 25 Associates' Subscriptions, @ 5s.,					6	5 0
,, Interest,					8	6 8
,, *Proceedings* sold,					7	13 3
,, Received from Mitchell Library—						
For *Proceedings*,		£2	19	5		
,, Carriage and Wrappers,		0	19	5		
,, Sets of *Proceedings* to Foreign Societies,		1	10	0		
					5	8 10
					£259	0 2½

From Balance of £90 10s. 6½d. falls to be deducted cost of *Proceedings* for 1896-97.

1897.—Aug. 31.						
By Rent and Attendance,					£10	19 6
,, Postage, Stationery, &c.,					19	6 3
,, Printing Circulars, Rules, &c.,					18	11 3
,, Printing *Proceedings*,					40	17 3
,, Carriage on *Proceedings*,					1	3 3
,, Carriage and Wrappers, Foreign *Proceedings*,					0	19 5
,, Portraits of the late Prof. King,					4	4 0
,, Lecture and Lantern Expenses,					3	15 6
,, Library—New Books,					13	16 5
Binding,					4	12 6
Insurance, 10s. 4d.; Postages, Stationery, &c., £2 14s.,					3	4 4
,, Balance, Life Members' Fund, on loan @ 4%,				*£47 0 0		
,, Balance, Ordinary Fund, on loan @ 4%,	*£40 0 0					
,, Balance, Ordinary Fund, in National Security Savings Bank,	56 0 0					
	£96 0 0					
Less due to Treasurer,	5 9 5½					
	90 10 6½				137	10 6½
					£259	0 2½

*On Security of Guaranteed Railway Stock.

Life Members' Fund—		
Invested in 2½ per cent. Debentures of The Modern Permanent Building and Investment Society, Melbourne,	£100	0 0
On loan at 4 per cent.,	47	0 0
	£147	0 0

GLASGOW, 15*th October*, 1897.—We have audited the above Accounts, compared same with the relative Vouchers and Securities, and have found them correct.

(Signed) WM. LEIGHTON, } *Auditors.*
JAMES JACK, }

November, 1898.

Natural History Society of Glasgow.

SESSION XLVIII.—1898-99.

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1893. Wilkie, Robert D., 302 Langside Road. HON. SECRETARY.
1898. Willox, David, 48 Burgher Street, Parkhead.
1879. Wilson, Rev. Alex. S., M.A., B.Sc., Free Church Manse, North Queensferry.
1897. Wilson, Miss Ina, 5 Middleton Terrace, Paisley Road, W.
1898. Wilson, Thomas, 77 New Road, Ayr.
1863. Wingate, John B., 7 Crown Terrace, Dowanhill.
1885. Wishart, R. S., M.A., Meigle Cottage, Stepps.
1852. *Young, John, LL.D., F.G.S., Hunterian Museum, The University.
1881. Young, John, F.Z.S., M.B.O.U., 64 Hereford Road Bayswater, London.

LIST OF ASSOCIATES.

1894. Arthur, Miss Annie, 7 Finlayson Place, Kelvinside.
1895. Brown, Miss Mary, 105 Buccleuch Street.
1890. Gibson, William, 76 St. James' Road.
1897. Goodfellow, Peter, 2 Alexandra Park Gardens.
1895. Gray, Allan, 95 Morrison Street.
1895. Henderson, Miss Annie, 38 Berkeley Street.
1894. M'Carron, Miss Janet, 41 Albert Drive.

1895. M'Culloch, Frank, 166 Sauchiehall Street.
1898. MacLean, Alex. Scott, M.I.M.E., Greenock.
1894. Niven, Miss Margaret R., 3 Abbotsford Place, S.S.
1897. Peck, Mrs. M. B., 9 Broomhill Gardens, Partick.
1897. Rogerson, John Stewart, 48 Windsor Terrace.
1888. Scott, Andrew, Fisheries Assistant, University College, Liverpool; 14 Lorne Street, Leith.
1888. Smith, Robert C., 2 Golfhill Terrace.
1897. Tennant, John, 13 Lorne Place, Mount Florida.
1895. Todd, Alex. C., 206 Darnley Street, Pollokshields.
1888. Wilson, P., Fisheries Office, Girvan.
1894. Zamorska, Miss Alberta, 32 Rupert Street.
1894. Zamorska, Miss Elma, 32 Rupert Street.
1894. Zamorska, Miss Wanda, 32 Rupert Street.

Robert Anderson, Printer, 22 Ann Street.

In Memoriam—George Walker Ord.

George Walker Ord, who died from peritonitis on 9th August, 1899, after three days' illness, was born in the parish of King-Edward, Aberdeenshire, in 1871, and was educated at Macduff Public School.

Of a delicate constitution as a boy, and with health rendered precarious by the rigours of the north-east climate, the class-room had more attraction for him than the playground, and he soon became a bright and favourite pupil of the head-master, Mr. Renton. On leaving school, he was sent to work in the fields, almost the only form of labour to be obtained in that part of the country, but one ill-suited for a delicate youth, and there can be no doubt that it is to his early experience here that must be attributed the sympathy he had with the labouring classes, and the remedies proposed for the amelioration of their condition.

Coming to Glasgow at the age of fifteen, he secured a post under the Corporation in the Kelvingrove Museum, and here his genius and temperament found congenial work, and his love for the study of natural history, which had already declared itself, became his abiding passion. The translation from the East Coast, with its consequent change of climate, brought about a remarkable and favourable change in his health, and within a year or so after his arrival in Glasgow he began his investigations into the flora and fauna of the West of Scotland, throwing into the work all the enthusiasm which characterises the youthful and ardent lover of nature. His abilities and rare aptitude for his professional duties were fully recognised by his superiors, and on the opening of the People's Palace in Glasgow Green he was appointed Superintendent. He did much good work at this Institution, and mention may be made in this respect of the Glen Collection of Minerals, Rocks, and Fossils, which he overhauled and arranged with all the loving care and patience of the most devoted geologist, while he displayed no mean skill in settling anew the identity of specimens whose labels had been lost, or had become detached and been replaced on the wrong specimen.

Mr. Ord attended the lectures at the Technical College on Botany, Chemistry, and Geology, and studied French and Spanish at the Glasgow Athenæum. He gained many valuable prizes and certificates at both Institutions, and at the Science and Art Examinations the merit of the earlier successes was confirmed by the gaining of the Department's first class certificates. He attended Professor Young's Lectures on Zoology at the University for one session, and was placed fifth on the examination list.

His first connection with scientific societies was with the Clydesdale Naturalists' Society, of which he was secretary for some time, discharging the duties of that office in a manner rare in one so young. After the dissolution of the "Clydesdale," he joined the Andersonian Naturalists' Society, where he was the popular Convener of the Entomological Section, an office which he held with much acceptance for several years. He became a member of this Society in 1896, and was a frequent contributor to its proceedings. An extremely keen observer and independent thinker, Mr. Ord was little inclined to take for granted authorities or text-books without first testing their teachings and examples by practical application in the field, and when an account of such inquiries was communicated in the form of a Paper, its freshness and the great vigour of his style commanded attention, and made criticism difficult. Members will still agreeably recall his last Paper before the Society, "The Lepidoptera in relation to Flowers," in which Sir John Lubbock's sins—principally of omission—brought him under the lash of the subject of this memoir. Mr. Ord was also a member of the Council and of the Research Committee of the Society.

In addition to the work ungrudgingly undertaken for the Natural History Societies he was connected with, Mr. Ord was an occasional contributor to the *Annals of Scottish Natural History*. He was a member of the Museums Association; and at the annual meeting of that body, held in Glasgow a couple of years ago, he read a paper on "Chemistry in Museums," in which he set forth, with the assurance of one who knew museum work well, a scheme for adequately representing in public museums some of the truths and beauties of a science whose study had afforded himself infinite delight. The essay was much appreciated by the members of the Association.

In connection with the British Association's visit to Glasgow in 1901, Mr. Ord was placed on the Botanical Committee for Phanerogams, and on the Zoological Committee for Macro-Lepidoptera, Tipulidæ, and Aphidæ.

Mr. Ord was a wide reader, and, having a retentive memory and a clear head, his knowledge was accurate and his judgment sound. Frank and unselfish to a degree, he had many friends in public and private life, and his large heart and sympathies made him ever ready to respond to the call of the less fortunate. A lovable companion and a faithful friend, may his memory ever remain green!

R. H.

Botanical Notes from Galloway for 1897-98.

By James M'Andrew, New Galloway.

[Read 29th November, 1898.]

The three South-Western counties of Scotland have now been so extensively botanized that comparatively few Flowering Plants must remain to be recorded. It follows, therefore, that my new records for Kirkcudbrightshire and Wigtownshire for 1897-8 are almost *nil*. In July, 1897, around Auchencairn, on the Solway Firth, I found *Poterium officinale*, Hook.; *Sagina maritima*, Don; *Ononis spinosa*, Linn.; *Galium Cruciata*, Scop.; *Juncus maritimus*, Lam. In Redhaven Bay I gathered *Teesdalia nudicaulis*, R. Br.; *Filago minima*, Fr.; *Filago germanica*, Linn.; and *Erodium cicutarium*, L'Hérit. About Bay View grow two rare plants, *Lepturus filiformis*, Trin., which also grows in plenty along the River Urr, south of Palnackie; and *Blysmus Caricis*, Retz., which I also found in 1896 at the mouth of the Kirkbean Burn. Along the west side of Auchencairn Bay are *Carex extensa*, Good.; *C. vulpina*, Linn.; *C. muricata*, Linn.; *C. disticha*, Huds.; and *C. sylvatica*, Huds.; and the grasses *Milium effusum*, Linn.; *Trisetum pratense*, Pers. (=*Avena flavescens*, Beauv.); and *Zostera marina*, Linn., in abundance on the muddy shore. Other

interesting plants farther south, some of them evidently outcasts or escapes, are *Doronicum Pardalianches*, Linn.; *Allium Scorodoprasum*, Linn.; *Rumex Hydrolapathum*, Huds.; *Datura Stramonium*, Linn.; *Impatiens parviflora*, DC.; *Cotyledon Umbilicus*, Linn.; *Veronica persica*, Poir.; *Crambe maritima*, Linn.; *Listera ovata*, R. Br. *Thalictrum flavum*, Linn., grows near Barlocco Cave. *Rhynchospora fusca*, Roem. and Schult., which I discovered in 1882, is still in fair quantity about the middle of Auchencairn Moss. Here also is *Andromeda polifolia*, Linn. The Rev. George Maconachie, Rerrick Manse, informs me of his rediscovery of *Paris quadrifolia*, Linn., near Dundrennan Village. Screel Hill has Oak, Beech, and Parsley Ferns, *Lycopodium clavatum*, Linn.; *Sagina subulata*, Presl.; and *Corydalis claviculata*, DC. *Statice Limonium*, Linn., and *S. rariflora*, Drej., cover a great extent of shore in Orchardton Bay, presenting really a beautiful sight. At Palnackie I gathered *Papaver dubium*, Linn.; and *Senebiera Coronopus*, Poir., thus confirming this plant for Kirkcudbrightshire. About Rascarrel Bay are *Carlina vulgaris*, Linn.; *Juncus obtusiflorus*, Ehrh.; *Verbascum Thapsus*, Linn.; *Sagina subulata*, Presl.; *Radiola linoides*, Roth. Around Auchencairn may also be noted the following plants:—*Mimulus luteus*, Linn.; *Plantago media*, Linn. (introduced with grass seeds), *Briza media*, Linn.; *Habenaria viridis*, R. Br.; *Genista tinctoria*, Linn., *Hypericum elodes*, Huds.; *Lycopus europæus*, Linn.; *Viburnum Opulus*, Linn.; *Bromus giganteus*, Linn., var. *triflora*, Syme; *Ranunculus sceleratus*, Linn.; *Conium maculatum*, Linn.; *Galium Mollugo*, Linn.; *Agrimonia Eupatoria*, Linn. In South Glen Bay grows *Rumex Hydrolapathum*, Huds., in abundance.

Near Castle Douglas was gathered *Allium carinatum*, Linn., making three stations for this plant in Kirkcudbrightshire. Around Carlinwark Loch I gathered *Callitriche autumnalis*, Linn.; *Potamogeton perfoliatus*, Linn.; *P. obtusifolius*, Mert. and Koch; *P. crispus*, Linn.; *Scutellaria galericulata*, Linn.; *Conium maculatum*, Linn.; *Rumex Hydrolapathum*, Huds.; *Lysimachia Nummularia*, Linn. (an outcast); *Nasturtium sylvestre*, R. Br., and *Nasturtium palustre*, DC.; *Glyceria aquatica*, Sm., and *Cicuta virosa*, Linn, &c. The Rev. H. M. B. Reid, Balmaghie Manse, lately pointed out to me a large patch of *Sambucus Ebulus*, Linn., near Balmaghie Church.

(1) *Sagina apetala*, Linn., and (2) *Arenaria serpyllifolia*, var. *glutinosa*, Koch, both at Creetown Station, are new records for Kirkcudbrightshire.

WIGTOWNSHIRE.—For all the new plant records for this county I am indebted to the Rev. James Gorrie, F.C. Manse, Sorbie. They are:—(1) *Ranunculus auricomus*, Linn., Newton Stewart; (2) *Pyrus Aria*, Linn., Castlewig; (3) *Cichorium Intybus*, Linn., near Garliestown; (4) *Mentha sylvestris*, Linn., Barglass; (5) *Carex Goodenowii*, var. *juncella*, T. M. Fries, Garliestown Curling Pond; (6) *Stellaria palustris*, Retz., near Newton Stewart; (7) *Dipsacus sylvestris*, Huds., Galloway House Woods; (8) *Ulmus montana*, Sm., Sorbie, &c. Mr Gorrie also gathered *Scabiosa arvensis*, Linn., at Barglass. Glasgow excursionists found *Isoetis lacustris*, Linn., in Loch Ochiltree; and I found *Hymenophyllum unilaterale*, Bory, in Knock Bay; and another station for *Calamagrostis epigeios*, Roth, at Craigoch Burn, Portpatrick.

The following new records of mosses may also be added:—(1) *Eucladium verticillatum*, Linn., Portpatrick; (2) *Thuidium recognitum*, Ldb., in plenty in the Glenkens, and also in the Screel Burn, Auchencairn; (3) *Orthotrichum affine*, Schrad., var. *rivale*, Wils., in Kenmure Holms, New Galloway; (4) *Hypnum intermedium*, Ldb., at Bogue, Dalry, and on Cairn Edward Hill, New Galloway.

Also, the following new records of Hepaticæ:—(1) *Lophozia bicrenata*, Lindb., at Portpatrick; (2) *Radula Lindenbergii*, Gottsche, in Knocknarling Burn, New Galloway; (3) *Lepidozia Pearsoni*, Spruce, in abundance on the north side of the Black Craig, New Galloway; (4) *Hygrobiella laxifolia*, Hook., in Lowran Burn, New Galloway.

Meteorological Notes, and Remarks upon the Weather during the Year 1898, with its General Effects upon Vegetation.

By James Whitton, Superintendent of Parks, Glasgow.

[Read 27th June, 1899.]

As in former years, and in order to preserve the continuity of the series, these notes are compiled from the records kept at Queen's Park.

January.—The weather at the opening of the year was dull and mild. On the 5th a dense fog enveloped the city, but with a rising barometer and the disappearance of frost the fog cleared off and better weather was experienced. Strong winds from the south-west on the 8th and 9th were followed by more settled and, for the season, mild weather. On the 22nd the wind again increased in force to a gale, and, accompanied by rain, caused considerable damage throughout the city. For the remainder of the month the weather was fine and open, and Christmas Roses (*Helleborus niger*, Linn.) and *Jasminum nudiflorum*, Lindl., were in bloom.

The barometer was lowest (29·10) on the 1st of the month, and highest (30·30) on the 23rd. Frost was registered on four days, and the total amounted to 6°, a striking contrast to the corresponding month of last year, when 143° were registered on 20 days. The rainfall was 2·42 inches with 18 dry days. The average maximum and minimum temperatures were 47° and 39°, as compared with 38° and 29° in the preceding January.

February.—Throughout this month the weather was changeable and boisterous. With a rapid fall of the barometer, a sharp westerly gale, accompanied by heavy rain, occurred on the 2nd, and continued throughout the 3rd, when frost set in which lasted till the 8th, with a slight fall of snow on the 6th. For a few

days thereafter the atmosphere was clear and mild, with occasional showers of rain. Strong south-west winds again prevailed on the 14th and 15th, and from the 18th to the 25th there was a spell of frost accompanied by showers of snow. Thunder was heard on the 26th, and on the 28th there was a heavy shower of hail and sleet.

Frost totalling 67° for thirteen mornings was registered during the month, while the average maximum temperature was 44°, and the average minimum was 33°. The total rainfall was 3·52 inches, and there were 11 dry days.

Vegetation at the beginning of the month was in an advanced state, many deciduous shrubs were almost bursting into bud, and *Rhododendron Nobleanum*, Hort., showed the tint of its flowers, while the growth of grass was remarkable so early in the season, but it received a decided check by the prevalence of cold winds and frost in the latter part of the month.

March.—The cold frosty weather of the closing days of February continued into this month with more or less severity until the 10th, when, with a change of wind to the south-west, better weather conditions prevailed. On the 16th the weather became boisterous and unsettled, and continued so till the close of the month. The maximum (day) temperature averaged 46°, and the minimum (night) 34°. Frost was registered on ten mornings, amounting to 45°. Dense fog was experienced on the 8th. The highest reading of the barometer was on the 25th, when it reached 30·15 inches, after which it fell gradually to 29·15 on the 29th, the lowest reading of the month. The rainfall was low for the month, only 1·65 inches being recorded, while there were 19 dry days. In the corresponding month in the two previous years the rainfall exceeded four inches.

April.—The month opened with fine clear weather. Frost was registered on only one morning during the month, and the thermometer touched freezing point on but one other occasion. There were 21 dry days during the month, and the rainfall was 1·65 inches. The average maximum temperature was 55°, and the average minimum 41°. The atmospheric pressure was comparatively steady throughout, the highest reading being 29·93 and the lowest 29·15.

Owing to the genial character of the weather the most of the trees in the parks burst into leaf, and shrubs into flower, especially

Rhododendron Eugenie, which was in full bloom by the 20th, making a pleasing display amid the shrubbery, while the bulbous plants in the plots in the parks and squares bloomed brilliantly, notably hyacinths and Narcissi. The earlier tulips, on the other hand, were not so good, owing to the hard drying winds of the preceding month having injured the expanding buds.

May.—The bright pleasant weather of the close of April did not hold through this month. The weather was backward, with hard cold north and north-east winds, and a tendency to frost at nights. Until the 12th the weather was dull and changeable, with frost and showers of hail on the 15th, after which hard dry weather was experienced till the close of the month. Frost was registered on four days, and amounted to 6°. The highest thermometer reading was 65°, and the lowest 30°. The average maximum temperature was 58°, and the minimum 40°, almost identical with that of May, 1897. The range of the barometer readings was wide, and varied from 30·10 on the 7th to 28·70 on the 11th, rising rapidly and steadily to 30·10 on the 19th. Until the end of the month it had a steadier but lower range. Rain fell on nine days to the amount of 2·04 inches, which is slightly under the amount recorded for the same month in 1897.

Vegetation, which was in a forward state in April, lost considerably, and was somewhat damaged by the cold winds and low temperature of this month. The tender leaves of the trees, particularly the Horse Chestnut, suffered severely by the sharp frosts and showers of hail which occurred between the 12th and 18th, and the fruit crops were likewise severely damaged. Several species of trees and shrubs bloomed remarkably well through this month, notably Cherries, Pyruses, and Lilacs; and the late-flowering tulips were very fine, compensating for the weak display made by the earlier varieties. The Oak leafed on the 6th, and the Ash on the 18th, the former 13 days and the latter 6 days earlier than in 1897.

June.—For the first fortnight there was a continuation of the cold unseasonable weather which characterised May, with easterly winds, and not until the 18th, when the wind changed to the south-west, did the weather become seasonably warm. With a low barometer (29·20) on the 1st, cold showers of rain fell, after which the barometer rose gradually, and the weather became

brighter though still cold. Towards the end of the month the weather became warmer and more genial. There were 18 dry days, while a rainfall of 1·98 inches was registered. The average maximum temperature was 64°, and the average minimum 48°, the former 2° higher, and the latter 1° lower than the means for corresponding month in 1897. The progress made by vegetation during the month was rather slow, and not at all in keeping with what is expected and generally experienced in June. The Laburnum, Elder, and late Rhododendrons, however, bloomed remarkably well.

July.—This proved to be the warmest and driest month of the year. The weather was warm and bright throughout. There were 24 dry days in the month, and the rainfall was only 1·46 inches. The thermometer in the shade was over 70° on seven days, while the average maximum and minimum were 67° and 49°, the former being the same, and the latter 1° less than the means of July, 1897. The barometer was steady and high, ranging from 29·43 to 30·15. The bright sunshine and genial warmth, with occasional showers of rain, gave an impulse to vegetation, and there was a good growth on most plants—those in flower-beds in the parks blooming profusely and brilliantly. Produce and farm crops made great and satisfactory progress, the hay crop being harvested under favourable conditions, while the bulk and quality were generally good.

August.—With the wind mostly from the south-west this month was somewhat rainy and changeable. The barometer was moderate and steady until towards the end of the month, when it fell considerably, and heavy rains were experienced. Some thunder was heard on the 16th, and on the 19th an easterly gale passed over the city. On the 23rd the wind again changed to the south-west, and the weather became warmer, with frequent showers of rain. The thermometer was highest at 76° on the 13th, and lowest at 41° on the 25th. The mean average temperatures—maximum 65°, minimum 51°—were lower than in the corresponding month of the previous year by 2° and 1° respectively.

For a number of years the rainfall of the month of August has been somewhat high, and though less than the previous year the amount is considerable, 4·77 inches being registered this year. There were only 15 dry days.

While favourable for the growth of grass and the filling up of cereals, the unsettled weather of this month was against the ripening and harvesting of the grain. Harvesting operations were accordingly later than usual, and were not begun in the Glasgow district until the middle of the month.

September.—The opening days were dull and wet, but, beginning on the 4th, fine warm weather prevailed for a week. On the 7th the thermometer in the shade rose to 78°, the highest recorded during the year. Thereafter until the 20th, though several days were fine and bright, the weather was somewhat changeable. The closing days were rainy and disagreeable. With the absence of frosts, the temperature was higher than in the previous September. The average day temperature was 63°, and the average night 48°, against 58° and 44° in 1897. There were 15 dry days, and rain fell to the depth of 3·99 inches, the amount being slightly less than in the same month of the preceding year. Owing to the amount of rainfall and the comparatively high temperature, many shrubs continued to make growth of a character unfitted to withstand satisfactorily the frosts of winter. The changeable atmospheric conditions and the frequency of fogs in the mornings caused serious trouble to farmers in securing grain crops. On exposed lands, by taking advantage of the fine spells in the weather, the crops were harvested in good condition. In low-lying and sheltered places unfavourable conditions were experienced.

October.—The first half of the month was dry and mild. On the 17th gales with heavy rains were experienced, causing the Kelvin to overflow its banks, and submerging the lower walks in Kelvingrove Park. From the 18th till the close of the month the weather was dull and showery, with occasional gales. The barometer was over 30 inches during the first week, and steadily fell to 29 on the 16th; thereafter it was very irregular, falling to 28·80 at the end of the month. The total rainfall was 3·97 inches, and there were 20 dry days. The average maximum and minimum temperatures were 54° and 46°, the former 1° and the latter 7° higher than in October, 1897. The high minimum is accounted for by the absence of frost. In fact, on only two occasions was the minimum thermometer below 40°, an unusual occurrence for October.

The genial weather in the beginning of the month enabled the late grain crops to be secured in excellent order, likewise benefiting the root crops to a great extent, whilst the trees were later in casting their leaves than usual.

Owing to the absence of frost, the flowers in the parks had a longer reign than usual, Dahlias being in bloom at the end of the month.

November.—Although somewhat rainy and unsettled, the first three weeks of this month were mild and open. On the 2nd and 3rd, gales were experienced, accompanied by heavy rains, the amount registered on these two mornings being 1·26 and 0·60 inches respectively. A heavy fog settled down over the city on the 11th, and continued intermittently for three days. The weather continued mild until the 23rd, when, with a sharp drop of the barometer and the wind veering to the north-east, it became much colder, and snow fell to the depth of a couple of inches. The first frost of the season was registered on the 22nd, when the thermometer suddenly fell to 22.° The following days were dull and frosty, with fog on the 30th. The total frost registered for six days was 43°. The barometric pressure was varied and erratic, ranging from 30 to 28·70. The rainfall for the month was 4·67 inches, with 18 dry days. The maximum temperature was 46°, while the minimum was 37°, in both cases 3° lower than in the preceding November.

Until the sharp frost on the 22nd, the freshness of the vegetation was remarkable, many tender plants blooming freely and altogether out of season.

December.—The weather of the month was changeable, and gales from the north-west were experienced more or less throughout it. On the 27th the storm reached its height, when it blew a severe gale, causing considerable damage to property and shipping. The barometer at this time reached the lowest reading of the year, 28·30. The barometric pressure during the month was extremely erratic, having a range of nearly two inches, the highest being 30·20 on the 20th, and the lowest 28·30 as already stated. There was a notable absence of frost during the month, only on four days did the thermometer go below 32°, and registering in all 17° of frost. The average maximum and minimum temperatures were 48° and 40°, in both cases considerably higher,

owing to the absence of severe frosts, than in December, 1897. The monthly rainfall was also the greatest of the year, being 6·32 inches as compared with 5·56 in the corresponding month of last year. There were only 11 dry days.

With the open weather the grass kept growing, and was much greener and fresher looking than usual at this season. However, probably owing to the absence of the natural rest, there was a paucity of bloom open on that characteristic plant, *Jasminum nudiflorum*, Lindl., which frequently is well in flower in November and December. On the other hand, towards the end of the month there was a notable growth on the part of Narcissi, in many cases the foliage being three inches above the ground.

In comparison with the records of previous years, the rainfall for 1898 (38·44 inches) is rather above the average, although it is less than that of 1897 (40·22 inches). Rain fell on 153 days, as compared with 160 in 1897. The wettest month of the year was December, 6·32 inches being registered. In 1897 June was the wettest, the rainfall being 5·67. The greatest rain for one day in 1898 was on 2nd November, when 1·26 was registered for 24 hours. The driest month of the year was July, with a rainfall of only 1·46 inches, as compared with that of the preceding year, when January had 1·22 inches. The following table shows the amount of rainfall registered in the parks where gauges are placed, in comparison with that of Queen's Park, on which records these observations are based. At the beginning of the year meteorological instruments were placed in Bellahouston Park and in Tollcross Park, and in September a set of instruments, similar to those in the Botanic Gardens, was presented to the Corporation by Mr. James Brown, Optician, St. Vincent Street, Glasgow, and was placed in George Square.

Allowance must be made for the difference in altitude, exposure, and situation of rain-gauges.

RAINFALL DURING 1898 IN THE PUBLIC PARKS.

	Queen's.	Maxwell.	Kelvin-grove.	Spring-burn.	Alex-andra.	Glasgow Green.	Bella-houston.	Toll-cross.
Height of Gauge above Sea-level.	145 ft.	69·1 ft.	48·3 ft.	361 ft.	141·4 ft.	34·7 ft.	160 ft.	85 ft.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
January, -	2·42	3·07	2·58	3·07	2·30	2·21	2·04	2·24
February, -	3·52	3·43	2·99	2·18	2·69	2.87	2·89	3·08
March, - -	1·65	1·26	1·74	1·64	1·61	1·27	1·47	1·69
April, - -	1·65	2·32	2·07	2·05	1·85	1·28	1·90	1·66
May, - -	2·04	2·26	2·40	2·19	2·68	2·59	2·27	2·81
June, - -	1·98	2·00	2·02	2·56	2·11	1·45	2·02	2·31
July, - -	1·46	1·67	1·35	1·75	1·62	1·36	1·48	1·62
August, - -	4·77	4·50	4·76	4·73	3·96	4·11	4·22	4·54
September, -	3·99	4·07	3·69	3·83	3·95	3·41	3·61	4·27
October, -	3·97	3·43	3·39	3·02	3·52	3·44	3·09	3·82
November, -	4·67	4·57	4·58	4·68	4·52	4·79	4·03	4·94
December, -	6·32	6·83	4·69	4·48	4·34	5·83	4·66	5·66
Totals, -	38·44	39·41	36·26	36·18	35·15	34·61	33·68	38·64

With reference to the temperature, the mean, 48°, is the highest for the past ten years, and may be accounted for by the mildness of the winter and the absence of any continued spell of frost. The highest reading of the day thermometer was 78° in the shade on 7th September, while in 1897 the highest reading was likewise 78°, on the 16th July. The thermometer was at or above 70° two days in June, seven in July, four in August, and seven in September, twenty times in all, as compared with twenty-seven times in 1897. The lowest reading was on 29th November, when the minimum thermometer fell to 18°, or 14° of frost. The amount of frost throughout the year was 190°, occurring on 42 days, though the thermometer was at the freezing point on other five days, and the coldest month was February, when frost to the extent of 67° was recorded on 13 days. In 1897, frost occurred on 61 occasions, the amount registered being 347°, and January was the coldest month, when the total amount of frost registered on 20 days was 143°.

The following comparative table of records taken at the different parks is of interest. As in the case of the preceding table of rainfall, allowance must here also be made for local conditions :—

1898.	Queen's Park.	Maxwell Park.	Kelvingrove Park.	Springburn Park.	Alexandra Park.	Glasgow Green.	Bellahouston Park.	Tollcross Park.
Thermometer (in shade 4 feet above ground level).								
Highest reading of year, ...	78°, 7th Sept.	80°, 13th Aug. and 7th Sept.	80°, 5th Sept.	77°, 6th Sept.	79°, 20th Aug. and Sept. 6 & 7	80°, 11th July	74°, 13th Aug.	82°, 7th Sept.
Lowest do. do.,	18°, 29th Nov.	14°, 29th Nov.	20°, 24th Feb.	26°, 24th Feb. and 14th May	15°, 29th Nov.	16°, 29th Nov.	21°, 29th Nov.	16°, 29th Nov.
Number of days on which thermometer fell to freezing point (32°), ...	47 days	104 days	60 days	30 days	90 days	84 days	46 days	75 days
Number of days on which thermometer did not rise above freezing point (32°),	0 days	2 days	4 days	0 days	1 day	3 days	7 days	1 day
Degrees of Frost registered—								
January, ...	6° on 4 days	46° on 11 days	24° on 6 days	4° on 2 days	29° on 8 days	28° on 7 days	9° on 4 days	20° on 7 days
February, ...	67 " 13 "	133 " 20 "	110 " 20 "	32 " 9 "	88 " 17 "	99 " 19 "	49 " 12 "	56 " 11 "
March, ...	45 " 10 "	126 " 21 "	70 " 15 "	21 " 10 "	83 " 19 "	84 " 18 "	30 " 8 "	53 " 13 "
April, ...	6 " 1 day	20 " 4 "	4 " 1 day	3 " 1 day	14 " 3 "	23 " 5 "	5 " 1 day	9 " 2 "
May, ...	6 " 4 days	41 " 10 "	...	6 " 1 "	18 " 8 "	19 " 7 "	2 " 1 "	15 " 5 "
June, ...	...	...	...	...	...	...	...	...
July, ...	...	...	...	...	...	...	...	...
August, ...	...	...	...	...	...	...	...	...
September, ...	...	14° on 4 days	...	...	6° on 3 days	2° on 2 days	...	...
October, ...	...	5 " 2 "	...	...	...	...	...	...
November, ...	43° on 6 days	90 " 14 "	25° on 5 days	10° on 3 days	77 " 12 days	70 " 11 days	38° on 7 days	42° on 9 days
December, ...	17 " 4 "	57 " 8 "	14 " 4 "	...	40 " 8 "	42 " 8 "	19 " 6 "	22 " 5 "
Total frost registered,	190° on 42 days	532° on 94 days	247° on 51 days	76° on 26 days	355° on 78 days	367° on 77 days	152° on 39 days	217° on 52 days

The directions of the wind for the year were as follows:— From the S. W., 219; W., 56; N. E., 20; E., 2 days respectively. Excluding the direct North and South, the Western group shows 283 and the Eastern 59 times. In 1897 the Western had 192 and the Eastern group 108.

Though severe gales were of frequent occurrence, especially during the last quarter of the year, none were of an outstanding destructive nature, in comparison with some experienced in recent years.

With reference to the atmospheric pressure, the range, as shown by the barometer records, has been more even than those of the two preceding years, and no extreme point has been touched. During the year the pressure was 51 times at or above 30 inches, 307 times below 30 and at or above 29 inches, and seven times below that point. The highest reading was on the 23rd January, when the barometer indicated 30·30 inches; and the lowest was on 28th December, when the pressure fell to 28·30 inches. In 1897 the highest reading was 30·40 inches on 30th December, and the lowest, 28·30 on the 5th March, with 73 times above 30 inches and 16 times below 29 inches.

In summarising the foregoing notes it may be observed that there were many points of resemblance in the weather conditions with those which were experienced in the two preceding years, notably the comparatively open, mild winter, with a copious rainfall and frequent south-westerly gales. The earlier months of the year were characterised by an abnormally low rainfall, but the deficiency was more than compensated for by the rainfall of the latter five months, seeing that the amount which fell is above the average for the preceding twelve years.

The ill effects of a succession of mild open winters and comparatively sunless summers, with heavy rains in autumn, are at first sight not very apparent on vegetation. When, however, certain subjects are regularly noted in regard to the various stages of their annual development, there are many interesting features shown, which point to the fact that seasons of that character are not the best for hardy plant life. A moderately hard winter with a clear and bracing atmosphere, followed by a summer of bright sunshine, with a good supply of rain in the autumn months,

is productive of the best results for vegetation. These conditions, while generally applicable, especially apply to deciduous trees and shrubs, amongst which are included the hardy fruits of this country. In the early part of the year, owing to the open weather, vegetation was too advanced, consequently on the occurrence of a somewhat long spell of hard, drying winds, the development of leaf and shoot was arrested, and the season's growth generally was not of a satisfactory nature. Owing to the trees being caught when in bloom by the cold winds and frosts in May, the crops of large fruits were considerably under the average, and in some places the small fruit likewise suffered. With regard to the annual plants, as the dry weather conditions suited the heavy soil of this district, the growth of such crops as the cereals was, though slow at first, steady and satisfactory, and the yield in straw and grain above the average. Some little trouble was experienced in harvesting, but, on the whole, these crops were secured in good condition. Turnips and potatoes generally were also good, although the turnip crop in the Glasgow district was superior to that of many localities considered more suitable for turnip cultivation. The hay crop was also excellent, and the season may, therefore, as a whole, be regarded as a good one for the farming industry in the West of Scotland. The wet weather in the later months of the year has been against the satisfactory working of land; while it has ill fitted evergreen shrubs to withstand the vicissitudes of a hard, frosty winter, seeing that the plant tissues are overcharged with moisture. There is a paucity of flower-buds on many evergreen plants, but many deciduous species are well budded and full of promise for a bright display in their season.

Subjoined is the meteorological record for the last three years, as kept at Queen's Park, and the average for the last twelve years.

COPY OF METEOROLOGICAL RECORD KEPT AT QUEEN'S PARK, GLASGOW.

Rain Gauge 145 Feet above Sea Level.

MONTHS.	1896.				1897.				1898.				Averages for the Last 12 Years.					
	Rainfall.	Thermometer. Average.		Dry Days.	Rainfall.	Thermometer. Average.		Dry Days.	Rainfall.	Thermometer. Average.		Dry Days.	Years.	Rainfall.	Mean Temperature.	Dry Days.	Number of Days on which 1° or more of Frost was registered.	Degrees of Frost registered.
	Inches.	Max.	Min.		Inches.	Max.	Min.		Inches.	Max.	Min.			Inches.				
January,	1·54	43	34	15	1·22	38	29	23	2·42	47	39	18	1887	25·78	47	203	97	417
February,	1·76	47	36	19	2·85	44	35	14	3·52	44	32	11	1888	32·33	46	190	81	232
March, ...	4·21	48	34	12	4·05	47	36	11	1·65	46	34	19	1889	26·18	47	194	59	250
April, ...	1·83	56	38	20	2·01	50	35	19	1·65	55	41	21	1890	38·04	47	170	74	273
May, ...	0·60	63	43	28	2·66	57	40	20	2·04	58	40	22	1891	36·09	46	184	85	371
June, ...	4·07	65	49	16	5·67	62	49	15	1·98	64	48	18	1892	33·84	45	194	101	798
July, ...	3·92	64	49	19	2·22	67	50	21	1·46	67	49	24	1893	33·05	47	186	56	306
August,...	1·64	63	48	20	5·51	67	52	13	4·77	65	51	15	1894	41·48	46	169	55	256
September,	4·71	59	46	10	3·39	58	44	16	3·99	63	48	15	1895	27·57	45	202	99	823
October,	3·70	48	34	17	1·71	53	39	23	3·97	54	46	20	1896	33·90	47	209	63	331
November,	1·07	46	35	20	3·37	49	40	17	4·67	46	37	18	1897	40·22	46	205	61	347
December,	4·85	40	31	13	5·56	43	33	13	6·32	48	40	11	1898	38·44	48	212	42	190
	33·90			209	40·22			205	38·44			212	Averages,	33·91	46°	193	73	383°

Conodonts from the Carboniferous Limestone Strata of the West of Scotland.

By John Smith. (*With Notes on the Specimens and Descriptions of Six New Species, by* Geo. Jennings Hinde, Ph.D., F.G.S.)

[Read 30th May, 1899.]

In the spring of 1876 I commenced to examine systematically the rotted limestones of Ayrshire. My first samples were from Cunningham Baidland, near Dalry, where the upper bed of the lower limestones was at that time being worked for agricultural purposes. By the action of acids, the limestone on each side of the rock jointings had been dissolved away to the extent of a few inches, the limestone beds having been rotted more or less at their edges, according to the purity or dirtiness of the stone. When the rock was quarried away along one of the master joints the quarry face presented the appearance of shelves of varying depths, and very rugged, owing to the limestone having been very irregularly dissolved. Each shelf contained a small quantity of a rusty-looking powder—the undissolved material of the limestone—and this powder was found to contain minute fossils which had been originally composed more or less of chitinous, phosphatic, or siliceous material, or had afterwards been more or less impregnated with silica.*

In searching the *shales* of the Carboniferous limestone for microzoa, our plan had formerly been to rub the material between the hands, for the purpose of removing the shale from the surfaces of the minute organisms. I soon found out that this plan would not do for the rotted limestone *débris*, for although many of the fossils looked quite complete, still the carbonate of lime they had contained had, in many instances, been sucked out, rendering them very tender.

* Although this is the usual mode of weathering of limestone, still the limestone in the Glencart section has weathered in a very different manner, the rotted part being full of subglobular cavities, an inch to two or three inches in diameter, the lower half, or even more, containing the undissolved powder.

At first sponge spicules, etc., were found in abundance (see *Annals and Mag. Nat. Hist.*, Nov. 1877) and of gigantic size compared with those of the present-day sponges, but minute and very fragile organisms were not suspected to exist in the rotted stuff, and it was only after using more delicate methods of preparing the material that Conodonts were found.

Having collected a number of specimens, I sent them to this Society for exhibition, and, if possible, to procure some information about them. As no one seemed to know what they were, I left them in the Hunterian Museum that they might be shown to visitors. The first caller who knew anything of them was Dr. Hinde, who, on their being shown to him by Dr. Young, at once pronounced them to be Conodonts, a class of fossil organisms first discovered by Dr. Pander, of Russia, and described in his monograph in 1856.

In Britain, Conodonts were afterwards found by Dr. J. Harley (*Quar. Jour. Geol. Soc.*, 1861, p. 542) in the Ludlow bone-bed; and by Mr. C. Moore in strata from the Silurian, probably up to the Permian (*British Association Report*, 1869, p. 375; and *Quar. Jour. Geol. Soc.*, 1879, p. 351); and in America a fine series has been procured from the Cambro-Silurian and Devonian rocks by Dr. G. J. Hinde, and described and figured by him—in three plates—in the *Quar. Jour. Geol. Soc.* for August 1879.

In the *Geological Magazine* for February, 1881, I recorded the finding of Conodonts from the Silurian rocks of the Wren's Nest, Dudley; Dudley Tunnel; Benthall Edge, and Lincoln Hill, near Ironbridge; Gleedon Hill, near Much Wenlock; Dormington, near Woolhope, all in Wenlock Shale; and from rotted limestone obtained in a quarry in the Upper Silurian (Aymestry limestone) strata near Craven Arms. Some time after this I got Conodonts in the rotted Devonian limestone of Newton Abbot (Devonshire), and in various English Silurian localities.

The Scotch Carboniferous Conodonts range from the bottom to the top of the limestone series, and are, generally speaking, rare, and, for the most part, confined to the limestones—an occasional specimen being found in the shales.

As Dr. Hinde does not mention the following in his "Notes," I may say that he submitted his specimens to the late Prof. Huxley,

who remarked on the resemblance of some of the Conodonts to the teeth of the Hag-fish (Myxine) (*Quar. Jour. Geol. Soc.*, 1879, p. 355); and the late Prof. Owen, in his *Palæontology*, 1870, states, from a microscopic examination, that Pander's genera *Ctenognathus*, *Cordylodus*, and *Gnathodus*, had some claim to Vertebrate rank, but they might be only the remains of the dentated claws of Crustacea. In his second edition he concludes that they have most analogy with the spines, hooklets, or denticles of naked molluscs or annelids. On this Dr. Hinde remarks (*Quar. Jour. Geol. Soc.*, Aug., 1879, p. 356), "That, however, the Conodonts cannot be referred to the horny jaws of annelids may be conclusively shown by the discovery by the writer of these annelidian structures in the same strata with Conodonts, from which the former can readily be distinguished by their chemical composition and their resemblance to the jaws of existing annelids. Against the probability of the Conodonts having been the teeth of molluscs it may be noted that the former are principally composed of carbonate of lime." *

These observations of Dr. Hinde I can confirm from having found specimens of annelid jaws in Scotch Carboniferous strata, and from the Wenlock shales of England.

Notes and Descriptions of New Species of Scotch Carboniferous Conodonts. By GEORGE JENNINGS HINDE, Ph.D., F.G.S.

At your request I have examined the beautiful collection of Conodonts which you have discovered in the Carboniferous strata of various localities in Ayrshire, and have compared them with the forms which occur in the Silurian, Devonian, and Carboniferous rocks of Canada and the United States, and also with the figures and descriptions of the same bodies from the similar formations in Russia, which have been described by Pander in his monograph; and I now send you a few notes respecting them.

These Scotch Carboniferous Conodonts are met with in a wonderfully perfect state of preservation. In all the specimens the surface

* From their appearance and state of *preservation* I should think that they must contain a large percentage of phosphate of lime.—J. S.

presents as smooth, polished, and lustrous an appearance as if they had been derived from some existing animal, and no one would suppose from their appearance that they dated from the long-past ages of the Carboniferous epoch. In some examples the minute denticles are more or less fractured, but this might readily happen even in recent objects of similar delicate structure [the fracturing is in most cases evidently recent], but in other specimens the teeth are as sharply pointed and their lateral edges as acute as if they had but recently been fulfilling their functions. They excel in their state of preservation those occurring in the American rocks, which are for the most part imbedded in shale or limestone, and but seldom met with free from the matrix, whereas these Scotch examples are perfectly free from matrix, and thus allow their forms to be much better determined. In composition and structure they appear to be identical with the American and Russian forms, and present a light-brown, translucent, horny aspect. One or two specimens are white and opaque, a difference owing probably to chemical change from exposure. There is equally as great a variety in the *form* of these Scotch Conodonts as in those from America and Russia, and, while many examples are identical with specimens which are common to these widely separated localities, there are other specimens which vary in detail from any which have yet been figured. Those latter I have indicated below by new names, though I by no means wish to assert that they are to be regarded as distinct species. Our present ignorance of the character of the animals to which these teeth belonged makes it a matter of conjecture as to the value to be attached to differences in their form; and the discovery which I made of numerous different forms of small teeth and plates associated together, so as to lead to the belief that they belonged to a single individual, renders it highly probable that, notwithstanding the great variety of form of these minute bodies, they may represent but a few species. In the meanwhile, however, it very desirable to ascertain and figure these different varieties, and until some happy discovery shall enlighten us respecting their relations to each other it will be convenient to give to each of them a distinctive appellation.

No fresh discovery either of fossil or recent forms of life has been made which would tend to clear up the doubts whether the

Conodonts are to be ascribed to the Vertebrate or Invertebrate sub-kingdoms. If they belonged to any division of the Invertebrata their size, form, and appearance would point towards the Mollusca, but the dental apparatus of existing forms of this division is siliceous, whereas the Conodonts are calcareous in their chemical composition. Besides, no Gasteropoda of sufficient size to have had lingual teeth of the dimensions of the Conodonts are found in the same beds with them, and it does not appear likely that naked forms of Mollusca would exist in any numbers without being accompanied by shell-bearing forms. It is interesting to note, however, that in these Ayrshire Carboniferous strata, as well as in America and Russia, the Conodonts are found associated with numerous undoubted fish teeth and scales of fishes. Some of these from the Ayrshire deposits are scarcely larger than the Conodonts, but their appearance readily allows them to be separated.

I append short descriptions of the various forms, and refer to the localities where those already described have been previously found. To avoid repetition of the references, I may here mention that the Russian Conodonts were described by Dr. Pander in his "Monographie der fossilen Fische des Silurichen Systems der Russischen—Baltischen Governments," St Petersburg, 1856. The Conodonts from the Carboniferous of Ohio are described and figured by Dr. Newberry in the 2nd volume of the "Palæontology of Ohio;" and those from the Silurian and Devonian of North America by myself in the *Quarterly Journal of the Geological Society* for 1879.

[For easy reference I may here give the stratigraphical position of the various localities in which I have found Conodonts in the Carboniferous limestone strata of the West of Scotland.

Stacklawhill, Stewarton. Glencart, Dalry. Monkcastle, Dalry. Linn Spout, Dalry.	Upper Limestones.
Orchard, near Thornliebank. Robroyston, near Glasgow. Limekilns, East Kilbride. Hillhead, Chryston.	Middle Limestones.

Cunningham Baidland, Dalry. Birkhead, Dalry. Law, Dalry. Low Baidland, Dalry. Auchenskeith, Dalry. Ponniel Water, near Douglas. Glenbuck, near Muirkirk.	Lower Limestones.

J. S.]

Descriptions of the Conodonts.

Polygnathus dubius, Hinde, *l.c.*, p. 362, pl. 16, f. 6-18.—Numerous small teeth and plates are associated together in this species, and some of the same form are present also in the Ayrshire deposits. The first of these has the basal portion flattened, and its lower margin slightly curved; near the centre of the base there is a compressed triangular large denticle, with from 4 to 10 similarly shaped smaller denticles on either side of it.

I have found this form in the Devonian of America, *l.c.*, pl. 16, f. 8; it also occurs in the Carboniferous of Ohio, *l.c.*, pl. 57, f. 1, 2, 13; and of Russia, *l.c.*, pl. 2A, f. 16.

[In the West of Scotland it occurs at Stacklawhill, Robroyston, and Birkhead. Plate IX., Fig. 1. Length, 1·3 mm.; rare.]

Centrodus duplicatus, Pander, *l.c.*, pl. 2A, f. 7.—Tooth with narrow, straight, elongated base, from which spring at right angles, or occasionally obliquely, prominent pointed denticles, and between which are smaller ones. It is present in the Devonian limestone of Canada, *l.c.*, pl. 16, f. 12, and the Carboniferous limestone of Tula, in Russia. [In Scotland it occurs at Monkcastle, Glencart, Birkhead, and Law. Plate IX., Fig. 12. Length of a broken specimen, 1·0 mm.; rare.]

Centrodus lineatus, Pander, *l.c.*, pl. 2A, f. 9.—The basal portion of this tooth is narrow, elongated, straight or curved, with numerous denticles arranged in a single series. Generally the denticles are unequal, every third or fourth being more prominent, and in perfect specimens a longer denticle is present near one extremity of the tooth. I have figured this from the Devonian of Canada, *l.c.*, pl. 16, f. 13; and it is also present in the Carboniferous of Ohio, *l.c.*, pl. 57, f. 4, 8; and of Russia. [In Scotland it occurs at Linn Spout, Glencart, Monkcastle, and Orchard.

Plate IX., Figs. 13, 14. Scarce; longest specimen found, 2·2 mm.; none is perfect.]

Polygnathus (Gnathodus) Mosquensis, Pander, sp. *l.c.*, p. 34, t. 10. —This tooth consists of a delicate compressed double-walled plate carrying a row of minute triangular flattened denticles on its upper edge; at one extremity the walls of the plate diverge so as to form unsymmetrical flanges on either side. Viewed from above the flange on one side of the central plate is slightly convex and ornamented with minute interrupted ridges and furrows. The flange on the opposite side is compressed and elevated so as to form a crenulated edge which runs nearly parallel with the upper margin of the central plate. Viewed from below the flanges are concave, and form a spoon-shaped depression with a deeply impressed line extending from the apex towards the free end of the plate. It closely corresponds with Pander's specimens from the mountain limestone of Moscow.

[In Scotland it occurs at Glencart, Linn Spout, Monkcastle, Stacklawhill, Robroyston, Birkhead, Cunningham Baidland, Law, and Glenbuck. Plate IX., Figs. 2, 3, 4. Comparatively frequent; 1·2 to 2·0 mm. in length.]

Polygnathus navicula, Hinde, new species. Plate IX., Fig. 5. —The basal portion of the tooth is triangular in outline when viewed laterally, its upper surface is a flattened plate, transversely striated, and with a median furrow. At one end there rises at right angles to the plate a thin crest with four or five saw-like denticles. This tooth is of the same character as the peculiar denticulated plates from the Devonian of Canada which are figured in the *Quar. Jour. Geol. Soc.* for 1879, pl. 17, f. 8-11, but differs in the form and disposition of the central crest. [From Ponniel Water, near Douglas. Only one specimen found; 1·7 mm. in length.]

Polygnathus (*Centrodus*) *convexus*, Pander, Mon., p. 31, t. 2A, f. 4.—Base of the tooth narrow and strongly curved, with a series of from 4 to 7 large, compressed, pointed denticles radiating from its upper margin. Sometimes minute denticles are intercalated between the larger. Pander's specimens are from the Lower Carboniferous of Tula. [In Scotland it occurs at Glencart, Monkcastle, Law, and Auchenskeith. Plate IX., Figs. 6, 7, 8. Specimens measure from ·8 to 2 mm. in length.]

Polygnathus scitulus, Hinde, new species. Plate IX., Figs. 9, 10, 11.—Tooth somewhat triangular, with a slightly curved basal margin with a sub-central well-developed cup-shaped cavity. At one extremity of the tooth is a large, compressed, triangular denticle with an acute outer edge; behind this is a series of 7 to 14 minute elongate denticles, closely disposed side by side. [In Scotland it occurs at Linn Spout, Monkcastle, Glencart, Hillhead, Orchard, and Limekilns. Specimens measure 8 mm. in length.]

Prioniodus Tulensis, Pander, Mon., p. 30, t. 2A, f. 18, 19, 20.—A relatively large curved tooth, with one or more horizontal or oblique divergent processes at its base, on which there are occasional and smaller denticles. These appear to be similar to Pander's specimens, which were from the lowest beds of the Carboniferous limestone in the province of Tula, Russia. [In Scotland it occurs at Glencart, Law, Glenbuck, and Skateraw, near Dunbar. Plate IX., Figs. 15, 16, 17. Specimens measure from 1·0 to 1·6 mm. in length.]

Prioniodus angulatus, Hinde. *Quar. Jour. Geol. Soc.*, 1879, p. 360, pl. 15, f. 17.—Tooth with an angular flattened base, with a prominent compressed denticle at the apex and several smaller on either side. It is present in the Devonian of New York and the Carboniferous of Ohio. [In Scotland it occurs at Glencart, Monkcastle, and Birkhead. Plate X., Figs. 18, 19. Specimens measure from 1·0 to 1·1 mm. long.]

Prioniodus spicatus, Hinde. *Quar. Jour. Geol. Soc.*, 1879, p. 361, pl. 16, f. 1-3.—Tooth with a narrow horizontal base, carrying a few minute denticles and a single large, curved, terminal denticle which is extended below into a small spiked process. It occurs in the Devonian of North America. [In Scotland it is got at Birkhead. Plate X., Fig. 20. Only one specimen has been found, ·5 mm. in length.]

Prioniodus peracutus, Hinde, new species. Plate X., Figs. 21, 22, 23.—A single straight or slightly curved, compressed main tooth which extends below a small horizontal base to an obtuse point, the outer margin, and both margins below the horizontal process, are acute. There are a few minute, closely set denticles on the horizontal base. This form differs from *P. spicatus* in its larger size, the sharp edges of the main tooth, and in the very

short horizontal base. [Occurs at Glencart, Robroyston, Monkcastle, Stacklawhill, Limekilns, Low Baidland, and Law. Specimens measure from ·8 to 1·5 mm. in length.]

Prioniodus complex, Hinde, new species. Plate X., Fig. 24.—Tooth with a slightly compressed sinuous base. At one end the primary denticle projects to form a spike-like process beneath the base; next to this is a large, upright denticle which is succeeded by a series of about 16 minute denticles. At the end of the base is another large denticle, obliquely projecting forwards, the front margin of which is minutely serrated. [Occurs at Linn Spout and Glencart. The largest specimen measures 1·4 mm. in length.]

Prioniodus geminus, Hinde, new species. Plate X., Fig. 25.—Basal portion consisting of two straight or slightly curved arms, carrying minute denticles often unequal in size; the arms meet at an acute angle, and at the apex is a large, compressed, double-edged denticle. [Occurs at Glencart and Linn Spout. A complete specimen measures ·7 mm.]

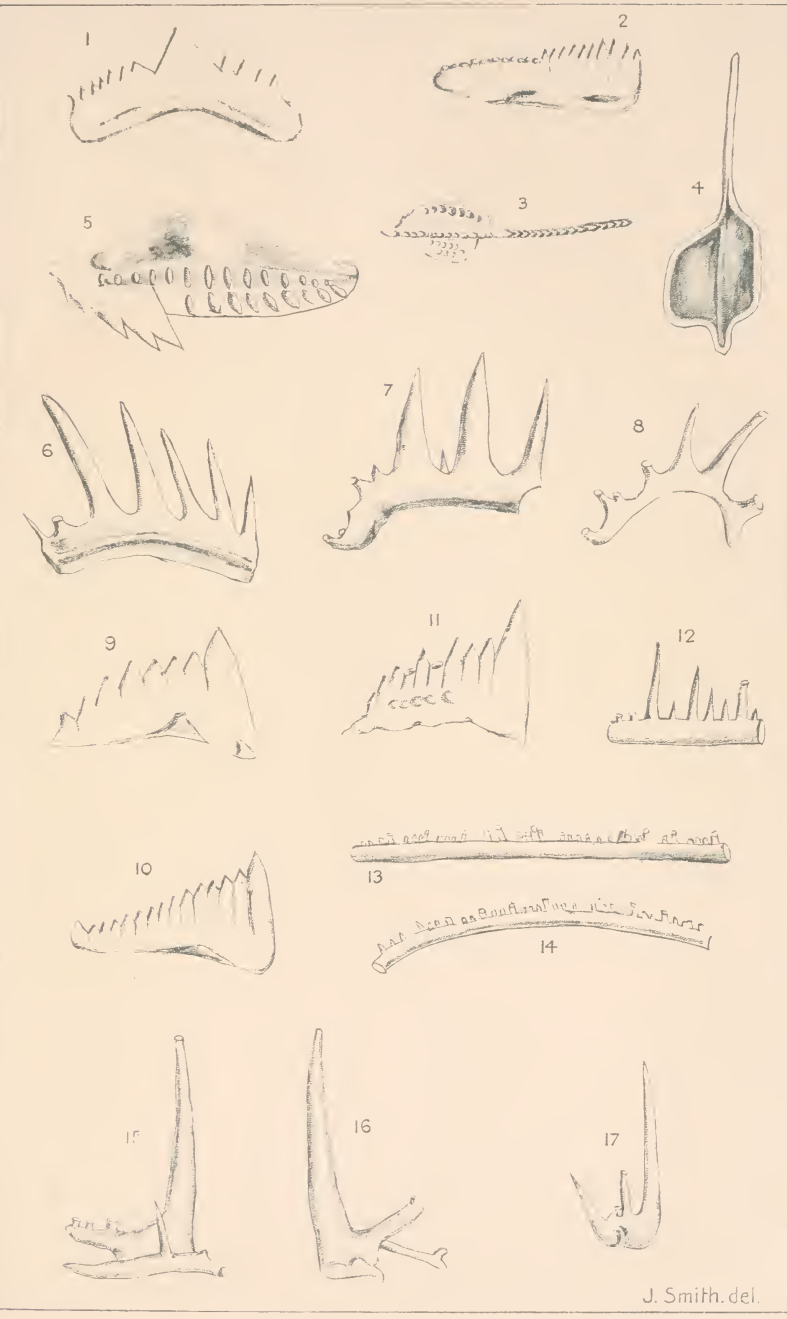
Prioniodus porcatus, Hinde, new species. Plate X., Fig. 26.—Tooth with a short, narrow, somewhat compressed base, which carries five or six minute, conical, obliquely placed denticles, and is terminated by a slightly curved, conical, acutely pointed larger denticle, which projects obliquely forwards. [Occurs at Monkcastle. Only one specimen found; 1·1 mm. in length.]

Cienognathus obliquus, Pander. Mon., p. 35, pl. 2A, f. 11.—The basal portion of the tooth is horizontal and compressed; at or near one extremity is a large conical, acutely pointed denticle at right angles or oblique to the base, with a series of minute sharply pointed denticles on one or both sides of it. [Occurs at Birkhead and Law. Plate X., Figs. 27, 28, 29. A complete specimen measures 1·4 mm. long.]

EXPLANATION OF PLATE.

Figure 1.—Polygnathus dubius, Hinde, ×24; from Lower Limestone, Birkhead, Dalry.

Figure 2.—Polygnathus (Gnathodus) Mosquensis, Pander, ×22 (side view); from Upper Limestone, Monkcastle, Kilwinning.



SCOTCH CARBONIFEROUS CONODONTS

SCOTCH CARBONIFEROUS CONODONTS

EXPLANATION OF PLATE—*continued.*

Figure 3.—Polygnathus (Gnathodus) Mosquensis, Pander, ×24 (top view); from Upper Limestone, Linn Spout, Dalry.

Figure 4.—Polygnathus (Gnathodus) Mosquensis, Pander, ×20 (under side); from Upper Limestone, Monkcastle, Kilwinning.

Figure 5.—Polygnathus navicula, Hinde, new species, ×22; from Ponniel Water, near Douglas.

Figure 6.—Polygnathus convexus, Pander, ×26; from Upper Limestone, Monkcastle, Kilwinning.

Figure 7.—Polygnathus convexus, Pander, ×25; from Upper Limestone, Dalry.

Figure 8.—Polygnathus convexus, Pander, ×20; from Upper Limestone, Monkcastle, Kilwinning.

Figure 9.—Polygnathus scitulus, Hinde, new species, ×22; from Upper Limestone, Linn Spout, Dalry.

Figure 10.—Polygnathus scitulus, Hinde, ×21; from Upper Limestone, Linn Spout, Dalry.

Figure 11.—Polygnathus scitulus, Hinde, ×20; from Upper Limestone, Monkcastle, Kilwinning.

Figure 12.—Centrodus duplicatus, Pander, ×20; from Upper Limestone, Monkcastle, Kilwinning.

Figure 13.—Centrodus lineatus, Pander, ×25; from Upper Limestone, Monkcastle, Kilwinning.

Figure 14.—Centrodus lineatus, Pander, ×29; from Upper Limestone, Monkcastle, Kilwinning.

Figure 15.—Prioniodus Tulensis, Pander, ×20; from Upper Limestone, Glencart, Dalry.

Figure 16.—Prioniodus Tulensis, Pander, ×25; from Lower Limestone, Law, Dalry.

Figure 17.—Prioniodus Tulensis, Pander; from Upper Limestone, Glencart, Dalry.

Figure 18.—Prioniodus angulatus, Hinde, ×32; from Lower Limestone, Birkhead, Dalry.

Figure 19.—Prioniodus angulatus, Hinde, ×22; from Upper Limestone, Glencart, Dalry.

Figure 20.—Prioniodus spicatus, Hinde, ×68; from Lower Limestone, Birkhead, Dalry.

Figure 21.—Prioniodus peracutus, Hinde, new species, ×27; from Lower Limestone, Law, Dalry.

Figure 22.—Prioniodus peracutus, Hinde, ×24; from Upper Limestone, Monkcastle, Dalry.

Figure 23.—Prioniodus peracutus, Hinde, ×30; from Lower Limestone, Law, Dalry.

Figure 24.—Prioniodus complex, Hinde, new species, ×23; from Upper Limestone, Glencart, Dalry.

EXPLANATION OF PLATE—*continued.*

Figure 25.—Prioniodus geminus, Hinde, new species, ×42; from Upper Limestone, Glencart, Dalry.

Figure 26.—Prioniodus porcatus, Hinde, new species, ×30; from Uppe Limestone, Monkcastle, Kilwinning.

Figure 27.—Ctenognathus obliquus, Pander, ×20; from Lower Limestone, Birkhead, Dalry.

Figure 28.—Ctenognathus obliquus, Pander, ×24; from Lower Limestone, Birkhead, Dalry.

Figure 29.—Ctenognathus obliquus, Pander, ×20; from Lower Limestone, Birkhead, Dalry.

Notes on some Crustacea from Fairlie and Hunterston, Firth of Clyde.

By Thomas Scott, F.L.S., Mem. Soc. Zool. de France, Naturalist to the Fishery Board for Scotland.

[Read 27th December, 1898.]

Fairlie, Hunterston, and Portincross are places on the Clyde, the names of which have been familiar to me for many years; yet the visit I am about to refer to is the first I have made to any of them. Among the various reasons that induced me to make this visit, the following may be given:—It is, for example, a notorious fact that not a few rarities, both botanical and zoological, have been recorded from one or other of the places named, and also that frequent reference to one or other of these places is to be found in natural history works of various kinds. Moreover, associated with the district are the names of some of our most eminent naturalists, who have occasionally made it their hunting ground, and have been rewarded by the interesting discoveries they have made. It might have been thought, however, that reasons like these should rather have tended to discourage the visits of subsequent investigators; such reasons were apt to suggest to the mind of the would-be discoverer, that the finding of all these rarities was a plain indication that the district must already have been more or less thoroughly examined, and was now scarcely likely to yield much that was

new or rare. Nature's storehouse, however, is not so easily exhausted.

The conformation of the shore about Hunterston is somewhat peculiar; as the tide recedes, great stretches of sand and mud are exposed, and are only covered to a small extent even when the tide is full in. There are also numerous pools along the shore, so situated that the water they contain may be almost fresh at one time, and at another time decidedly brackish. Such a conformation presents conditions favourable to the existence of organisms that, in the great chain of life, constitute some of the links between those creatures whose habitat is the sea, and those that can only live in fresh water. Amongst the various groups of the animal kingdom, few of them contain such an interesting series of intermediate forms as that of the Crustacea. In Britain these intermediate forms are mostly of small size, and their study is considered to be correspondingly difficult. It therefore happens that the study of these Micro-crustaceans is not so popular as it deserves to be. Reflection on those matters led me to think that, notwithstanding all previous research, Hunterston might still retain some things that would more than repay the trouble incurred in the search for them.

My visit took place on a Saturday, early in September last, when various things conspired to make it successful. The weather could hardly have been better. I had also as a guide an old and esteemed friend, who was thoroughly familiar with the district, Mr. D. A. Boyd, of Seamill; and another old friend, Mr. James Steel, of Glasgow, also accompanied us. Our research commenced at Fairlie, and was continued till we were well round the Hunterston Sands. The shore pools were examined with a little hand-net, an instrument that has proved very serviceable for this kind of work. I confined my attention chiefly to these shore pools, as, after a little experimenting, it was found that they were likely to yield the best results, and in them a large number of the species I am now to record was secured. The Entomostraca obtained number fully sixty species, and there are also about eleven species of Amphipoda and Isopoda.

The Entomostraca include representatives of the Copepoda, the Ostracoda, and the Cladocera. The Copepoda are the most

numerously represented, and there is also a considerable number of the Ostracoda; but the Cladocera are represented by only two species. This latter group, though frequently individually numerous in the sea, and sometimes also in brackish water, does not usually in such situations exhibit much variety of form; but when fresh-water pools or lochs are examined, very different results are obtained—the Cladocera are generally found to be not only numerous individually, but are also represented by a considerable number of species.

The names of all the Entomostraca, as well as of the Amphipoda and Isopoda, obtained during our visit to Fairlie and Hunterston, so far as they have been identified, will be found in the annexed list. A glance at the list will show that the Copepoda are represented by thirty-eight named species, several of which have not previously been recorded for the Clyde; and there are at least other two that appear to be undescribed. The Ostracoda are represented by twenty-two species, none of which is new to the Clyde, but a few of them are moderately rare. The Cladocera comprise two species, as already stated. The Amphipoda are also few in number, only three species being observed. The Isopoda observed number eight species. This makes a total of seventy-three species of Crustacea, exclusive of the two or three that appear to be new, and will be described later. A larger number of Amphipoda and Isopoda might have been obtained had a special effort been made to collect these forms, but, as the chief object of my visit was to investigate the Entomostracan fauna of the place, comparatively little attention was given to the other groups.

List of the Crustacea obtained during a visit to Fairlie and Hunterston, so far as they have been identified. A large proportion of the Copepods and Ostracods obtained is from the brackish water pools that have been referred to; the others were collected between tide-marks.

Copepoda.

Eurytemora velox (Lillj.).
Cyclops bisetosus, Rehberg.
serrulatus, Fischer.
fimbriatus, Fischer.
æquoreus, Fischer.
Cyclopina gracilis, Claus.
Ectinosoma melaniceps, Boeck.
curticorne, Boeck.
herdmani, T. and A. Scott.
Bradya minor, T. and A. Scott.

**Tachidius brevicornis* (Müller).
littoralis, Poppe.
**Ameira exilis*, T. and A. Scott.
Delavalia palustris, G. S. Brady.
giesbrechti, T. and A. Scott, var.
Canthocamptus palustris, G. S. Brady.
minutus, Claus.
parvus, T. and A. Scott.
**Moraria poppei* (Mrazek).
Mesochra lilljeborgii, Boeck.
Diosaccus tenuicornis (Claus).
Laophonte curticauda, Boeck.
similis (Claus).
* *littorale*, T. Scott.
* *intermedia*, T. Scott.
Cletodes propinqua, B. and R.
longicaudata, B. and R.
Itunella tenuiremis (T. Scott).
**Nannopus palustris*, G. S. Brady.
Platychelipus littoralis, G. S. Brady.
Dactylopus tisboides, Claus.
stromii (Baird).
Thalestris forficulus, Claus.
harpactoides, Claus.
Harpacticus chelifer (Müller).
fulvus, Fischer.
Westwodia nobilis (Baird).
Idya gracilis, T. Scott.
Also two species apparently new to science, which will be described and figured later on.†

Ostracoda.

Cypris incongruens, Ramdohr.
Cyprinotus prasinus (Fischer).
Herpetocypris tumefacta (B. and R.)
Cypridopsis villosa (Jurine).
aculeata (Lillj.)
Ilyocypris biplicata (Koch).
Candona candida (Müller).
compressa (Koch).
Cythere lutea, Müller.
pellucida, Baird.
porcellanea, Brady.
Cythere gibbosa, B. and R.
villosa (G. O. Sars).
Cytheridea torosa (Jones).
Loxoconcha impressa (Baird).
pusilla, B. and R.
Xestoleberis aurantia (Baird).
Cytherura sella, G. O. Sars.
nigrescens (Baird).
gibba (Müller).
Cytherois fischeri (G. O. Sars).
Paradoxostoma variabile (Baird).

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* Additions to Clyde Fauna.

† These two species are described in Part III. of the Seventeenth Annual Report of the Fishery Board for Scotland (1899), under the names *Cylindropsyllus farliensis*, sp. n. and *Leptocaris minutus*, gen. et. sp. n.

CLADOCERA.

Alona guttata, G. O. Sars. *Alona affinis*, Leydig.

AMPHIPODA.

Orchestia mediterranea, Costa. *Apherusa jurinii* (M. Edw.)
Gammarus duebeni, Lilljeborg.

ISOPODA.

Jæra marina (O. Fabricius). *Eurydice pulchra*, Leach.
Sphæroma rugicauda, Leach. *Idothea baltica* (Pallas).
Ligia oceanica (Linné). *Oniscus asellus*, Linné.
Porcellio scaber, Latreille. *Philoscia muscorum* (Scopoli).

NOTES ON SOME OF THE SPECIES.

As a detailed description of all the species mentioned in the list is beyond the scope of this Paper, I confine my remarks to a few of the rarer forms only, and chiefly to those among the Copepoda, as follows:—

COPEPODA.

(1) *Eurytemora velox* (Lilljeborg).—This species, so far as its British distribution is concerned, is most frequently found in brackish water, and more rarely in fresh water. Though it has not previously been noticed in the Hunterston district, it has on several occasions been recorded from places within the Clyde area, as at Rutherglen, where it was obtained by Mr. James Steel, and in Possil Marsh—these two are fresh-water localities; at Langbank, where I observed it two years ago; and at Cumbrae, whence it is recorded by Prof. G. S. Brady. *E. velox* was quite common in some of the pools at Hunterston, and, being a moderately large species, the two younger members of our expedition could, with their keener eyesight and without artificial assistance, see the creatures quite distinctly swimming in the water.

Ectinosoma curticorne, Boeck.—This species is probably more common in the Clyde district than it at present appears to be; it is usually of a brownish colour, and as this harmonises with the sort of material in which it commonly occurs, it is readily passed over unobserved. In the examination of gatherings collected by

hand-net, one has to be very much on the alert, as colour mimicry, as well as mimicry of form, is by no means rare among these low forms. *E. curticorne* has only lately been recognised as a Clyde species. My son records the interesting fact concerning it that young dabs from Morecambe Bay were found to have been feeding largely on this Entomostracan. He had obtained numbers of them in the stomachs of the young fish.[1]

Ectinosoma herdmani, T. and A. Scott.—This is quite a different species from the last, being more slender and elongate; its colour is white, or nearly so, and it is readily distinguished from any other British member of the genus. Though added to the British fauna only a few years ago, it does not seem to be very uncommon; probably its distribution is local.

Bradya minor, T. and A. Scott.—The species belonging to the two genera *Ectinosoma* and *Bradya* are so like each other in general appearance, that in some cases it is hardly possible to tell the genus to which they belong without dissection; one can usually, however, distinguish between *Ectinosoma* and *Bradya* by the difference in the structure of the posterior foot-jaws. *Bradya minor* has a superficial resemblance to *Ectinosoma curticorne*, but is not so dark coloured. These two resemble each other also in their habitat, which appears to be more or less estuarine.

Tachidius brevicornis (Müller) and *T. littoralis*, Poppe, were both found in the brackish pools at Hunterston. This is the first time *T. brevicornis* has been recorded from the Clyde area, but the other has been previously recorded. The genus is readily distinguished from other British Copepods by the structure of the fifth pair of thoracic feet, but *T. brevicornis* has fifth feet that are large and foliaceous, while those of *T. littoralis* are small, and their setæ are rather spinuliferous than plumose.

Ameira exilis, T. and A. Scott, is an addition to the Clyde fauna. It is a moderately large species, and was discovered a few years ago, near Dunbar, on the East Coast.

Canthocamptus parvus, T. and A. Scott.—This species was first discovered in Aberlady Bay, Firth of Forth, and is now for the first time added to the Clyde fauna. Though a small

[1] *Trans. Lin. Soc.*, 2nd Ser., Zool., Vol. VI., Part 5, p. 431.

species, it appears to have an extensive distribution ; it has been obtained as far north as Franz Josef Land. It was described as a Canthocamptus, but may ultimately have to be removed from that genus.

Laophonte littorale, T. Scott, and *L. intermedia*, T. Scott.—These two species are also additions to the Fauna of the Clyde. They have only been described within recent years, but both appear to be widely distributed.

Nannopus palustris, G. A. Brady.—This curious Copepod appears to be a true brackish-water form, and this is, so far as I know, the first record of it for the Clyde. It seems to be a scarce species, though its rarity may be rather apparent than real, as the following incident would seem to indicate :—A short time ago I had an opportunity of examining some raised-beach material from Skye. The material was quite dry, having been collected a good while ago. In turning over the material I observed some objects that looked like Copepods, but they were so shrivelled up as to be indistinguishable. A careful treatment of them with caustic soda, however, relaxed the shrivelled-up skin and appendages, so as to render the discrimination of their structural details comparatively easy. I then found that a few of these mummified Copepods belonged to the species now under consideration, and was enabled in this curious way to extend somewhat our knowledge of the distribution of *Nannopus palustris*. There had likely been some marshy ground in the vicinity of the raised beach where the material had been collected, and, being near the sea, would form a suitable habitat for Nannopus, and probably other brackish-water species, and in the dry weather it would be a comparatively easy matter for the Copepods to become incorporated with the outer layers of the raised-beach deposit, and be mixed up in the sample collected.

Platychelipus littoralis, G. S. Brady.—This is another curious Copepod, with strong hooked terminal spines on the first thoracic feet which remind one very much of those iron hooks which are sometimes used by people who have the misfortune to lose a hand. Though found in brackish water, Platychelipus is not such a true brackish-water species as the last ; its distribution should rather, perhaps, be described as "estuarine."

Thalestris forficulus, Claus.—This is a very distinct species of Thalestris. The branches of the first thoracic feet are long and slender in comparison with those of most of the other members of the genus; it is also a small species. A few years ago we described, under the name of *Thalestris forficuloides*, a Copepod that seemed to be different from Claus's species, but both my son and I are now inclined to regard this as merely a local form of *T. forficulus*.

The two apparently undescribed Copepods found in the Hunterston pools are both very slender and both appear to be rare. Only four specimens of the larger and rarer of the two have been observed, but specimens of the smaller form were somewhat more frequent. These smaller specimens were difficult to notice, because they so closely resembled the bits of fibre with which they were mixed up; it was on this account easy to miss them, and therefore they may have been less rare than they appeared to be.

Another Copepod, which I have recorded as *Delavalia giesbrechti*, var., resembles that species very closely. The typical *D. giesbrechti* was discovered in Ayr Bay about two years ago. It has a peculiarly broad terminal seta on each of the caudal furca, and it may be distinguished by this character alone. In the Hunterston variety the caudal setæ are of the usual form. The arrangement of the setæ on the fifth thoracic feet also differs slightly from the typical form, but it agrees in so many other points, that it seems better, for the present at least, to consider it as a local variety of *D. giesbrechti* than to make a new species of it.

Among other doubtful Copepods is an Harpactid that partakes somewhat of the characters of *Canthocamptus cuspidatus* and *Moraria poppei*, but it differs from them in various ways, but especially in the form and armature of the fifth thoracic feet, and I have not yet decided what to make of it.

These intermediate forms are very troublesome to the systematist. Their differences are such that they cannot very well take their place beside species already described, yet their affinities with them are so close that one hardly knows where to place them, or what characters to fix upon in order to discriminate them from others. This is where the chief difficulty in the study of the Copepoda comes in.

Ostracoda.

Very few of the Ostracoda require special notice. The fine species *Cypris incongruens* was moderately common in some of the pools; being moderately large and of a light cream colour, they were quite conspicuous in the gathering when transferred from the hand-net to the bottle. *Cyprinotus prasinus* was also moderately common. This species is perhaps more familiar to Glasgow students under the name of *Cypris salina*. *Cypridopsis aculeata* is another Ostracod that was more or less frequent. As the name implies, the shell of this species is covered with stiff bristles. *Candona candida* is, though a common species, a very pretty one—the surface of the shell is a smooth, glossy white. It is also a somewhat interesting species from the fact that it seems to be equally at home in water that is more or less brackish and in perfectly fresh water; the form of the shell is also subject to a good deal of variation. It has never been found living in any truly marine locality. *Cytheridea torosa* is another brackish Ostracod, and it seems to be more restricted in its distribution than any of the species previously mentioned. *Cythere gibbosa* and *Loxoconcha pusilla* are also brackish-water species, but they differ from the others already referred to in this way—the distribution of those first-mentioned species may be described as extending from the brackish water towards fresh-water conditions, whereas the distribution of these two appears to extend more or less towards marine conditions. *Xestoleberis aurantia* and some others are also in the same category with *Cythere gibbosa* as regards general distribution.

Amphipoda.

The three Amphipods mentioned in the list appear to be all generally distributed within the Clyde area wherever suitable conditions prevail. *Orchestia mediterranea* appears, however, to to be somewhat rare. Dr. Robertson mentions that he saw only two Clyde specimens—one from the mouth of the Garnock (sent by Mr. J. Smith), and one taken at the west end of Cumbrae.[1] The "hand" of the second Gnathopods is quite different in form

[1] *Catalogue of the Amphipoda and Isopoda of the Firth of Clyde.* By David Robertson, F.L.S., etc Part I., p. 13 (1888).

from that of the more common *Orchestia littorea*, being somewhat pear-shaped, broad at the base, while a strong claw springs from the narrow apex; and the palm is furnished with a distinct tooth near the base of the claw.

Isopoda.

All the Isopods mentioned in the list have already been recorded for the Clyde area; they are all included in Dr. Robertson's *Catalogue of the Amphipoda and Isopoda of the Firth of Clyde*, published by this Society a few years ago.

The Lepidoptera in relation to Flowers.

By George W. Ord.

[Read 28th March, 1899.]

Nowhere in the annals of Darwinism has a battle raged more fiercely, than in regard to that application of the theory of natural selection which deals with the relationship between plants and insects. No doubt the insect selection theory, in that it has encouraged research, has done great good, and there can be equally little doubt that it has a broad basis of truth. That cross-pollination is necessary for many plants, and desirable for all, no botanist doubts. Further, that the agency of insects is in many cases absolutely essential for such cross-pollination is also indisputable; and when we find that in many such cases the form of the flower and the arrangement of its parts are such as to make fertilisation by visiting insects a certainty, we are fully justified in believing that that form and that arrangement must in some way be connected with the long continuance of such visits.

The theory stated so broadly is practically unassailable, but it was not necessary to try to prove that every freak of plant nature, every line and every shade of colour, was thus brought about. Yet this is exactly what has been attempted. Sir John

Lubbock, in his *British Wild Flowers in relation to Insects*, says—"To them (*i.e.*, insects) we owe the beauty of our gardens, the sweetness of our fields. To them flowers are indebted for their scent and colour, nay, for their very existence in its present form. Not only have the present shape and outlines, the brilliant colours, the sweet scent and the honey of flowers been gradually developed through the unconscious selection exercised by insects, but the very arrangement of the colours, the circular bands and radiating lines, the form, size, and position of the petals, the relative situation of the stamens and pistil, are all arranged with reference to the visits of insects, and in such a manner as to ensure the grand object which these visits are destined to effect." The portion of this extract relating to scent and colour is especially unfortunate, for the scent often characterises, not only the flower, but the whole of the plant, and the foliage leaves often display very vivid and varied colours. In the animal world we have many examples of vivid coloration, which are apparently unexplainable either on the ground of protective resemblance or of sexual selection. The beautiful colouring of the hind wings of many Noctuæ, both male and female, is but one instance in point. Yet Sir John Lubbock careers through the British Flora, proving his proposition to his own satisfaction. Occasionally he contradicts himself, as in the two statements relative to the Bistort (*l.c.*, pp. 20 and 158). "Thus *Sarcophaga carnaria* visits *Polygonum Bistorta* in search of honey, although that flower does not contain any;" and "other species, such as *P. Fagopyrum* (the Buckwheat) and *P. Bistorta*, are much more conspicuous, contain honey, and are fertilised by insects."

Now and again Sir John finds himself confronted by an awkward fact, such as the exceedingly attractive and rather inconspicuous Lime-tree blossom, which he passes over with this rather remarkable sentence—"Their abundance (*i.e.*, the flowers), and the size of the tree render colour unnecessary."

Does any meaning attach to a sentence like that? Let us try and work it out. The Apple-tree is melliferous, has many flowers, is of considerable size, therefore colour is unnecessary! The Horse-chestnut is a large tree, with many nectar-bearing flowers, therefore colour is unnecessary.

The principal part in Sir John Lubbock's work is assigned to the

Bee, but a not inconsiderable portion falls to the share of insects belonging to the order Lepidoptera. Certain genera of plants, like Lychnis and Lonicera, have advanced even beyond the Bee; and the long proboscis of the Butterflies and Moths comes into play. Had Sir John Lubbock been a lepidopterist, he would never have set down the species of Lepidoptera visiting the Ragwort as three in number, nor would he have passed over the Ivy with a reference to Flies and Wasps. It is a matter for regret that lepidopterists, as a rule, have paid little or no attention to this subject. They have been too busy with the great problems of variation and distribution to think of others. In giving lists of species captured, they will note the geological and geographical features of a district, as well as its characteristic plants, but they seldom tell us what flowers they found to be frequented by insects, far less do they give us a list of the species frequenting each flower. When I say this, I of course exclude the working of the Sallow and Ivy blossoms, which every lepidopterist tries at one time or another during the course of his life. Beyond these two, if the plants are mentioned at all, the reference is usually indefinite. In going over some volumes of the *Entomologist* recently, I found a very interesting list of species which had been taken at the flowers of "a kind of vetch," and a still more remarkable list of Moths captured at the flowers of "various grasses." I fancy it would have interested most naturalists to know what grasses, so universally set down as wind-fertilised, have the power of attracting insects, and what species of Moths were attracted to each particular grass.

Nearly all the great insect orders have their representatives among the winged battalions of the evening and night. It is then that the great Water Beetles, and the still more noisy Dung Beetles, go booming through the air. Over the ponds the Caddis-flies keep up, hour after hour, their endless serpentine dance, and the whole atmosphere is thick with Gnats, Midges, and other two-winged flies. The night-flying species which are attracted to flowers belong almost entirely to the Lepidoptera, but there may be exceptions. *Sirex gigas*, Linn., has been known to occur at "sugar," and most insects which go to "sugar" will also go to flowers. The reverse hardly holds good. It is, then, with the Moths that I have to deal in this paper.

The Lepidoptera, which are most voracious feeders in the larval state, when they have reached the imago state indulge only in an occasional sip of honey by way of refreshment. For a supply of honey they have two natural sources—

(1) Flowers—the principal source.

(2) An exudation of certain Aphides, particularly of species belonging to the genus Lachnus, known as "Honey-dew."

In supplying insects with honey, flowers are supposed to demand of them certain services; but, so far, no one has ventured to suggest that the Aphis also asks a *quid pro quo*. The plant-lice are the most unselfish of creatures. Without recompense, they provide sweets for Ants, Wasps, Moths, Flies, and even Beetles.

A taste for sweets in any shape or form we can understand, but many species are attracted by things which we can hardly call sweet, among them being the berries of the Yew, the resinous exudations of various conifers, and putrid flesh. This last degraded taste has been shown by certain species of that magnificent family of Butterflies, the Nymphalidæ—including the only British representative, *Apatura iris*, Linn. But when we have counted up the species partaking of all these, we find that a very large proportion of the order remains unaccounted for. These species seem in the imago state to require no nutriment whatever, living on the strength they have stored up during their period of youthful voracity.

Let us then take the great divisions of the British Lepidoptera, and tabulate them according as they do or do not visit plants for their juices, using the old classification as most convenient.

ORDER LEPIDOPTERA.

Flower-frequenting.	Non-Flower-frequenting.
Rhopalocera (Butterflies).	*Bombyces* (Silk-spinners), except *Thyatira batis*, Linn.
Sphingidæ (Hawk-moths, etc.)	*Geometridæ* (Loopers), except Larentia, Eupethecia, Anticlea, Iodis, Cidaria, etc.
Noctuæ (Night-hawks).	*Pyralididæ*, except Pionea, Scopula.
Pterophori.	

With the Crambi, Tortrices, and Tineæ I shall not attempt to deal. I have found species of each division on flower-heads, but the probability is that the great majority pass their lives in the winged state without honey.

It is an axiom in biology that when an organ remains long unused it becomes atrophied, and this is strikingly exemplified in the table I have given. In the most of the Bombyces the tongue is very much degraded. In Arctia and its allies it is still in evidence, but it is almost quite obsolete in the true Bombyces, as in the typical species, *Bombyx quercus*, Linn., and *B. rubi*, Linn. The position of the group formerly known as the Cuspidates, tells the same story; in the genus Cilix, for instance, the tongue has quite disappeared. Many of the Geometers are rapidly going the same road, and this is specially evident in those species which have wingless females. In *Nyssia zonaria*, Schiff, and most of the species of the genus Hybernia, the tongue is either obsolete or rapidly becoming so. Most of the species of the latter genus make their appearance in the winter time, when no flowers are to be found, so that abstention must have been forced upon them. *Hybernia progemmaria*, Hüb., which appears in the spring, has been recorded as occurring at Sallow blossom.

On the whole, it may be said that those families of the Lepidoptera which are slow of flight, show the least predilection for flowers, whilst the swifter species, which are continually on the wing, are the most frequent visitors to the honey providers. The males of many of the Bombyces are exceedingly swift, but as a rule they remain on the wing only for a short time. The one object in the life of these insects is the reproduction of the species. The Geometers are for the most part slow, and as they are, on the whole, denizens of woods, never wandering far from their place of birth, abstemiousness may have been with them more a matter of necessity than choice.

Even in the families which I have placed on the other side we find great differences. Among the Rhopalocera, or Butterflies, all the species are not alike constant in their attention to flowers. The Pieridæ and Vanessidæ spend practically the whole of their time courting and nectar-imbibing. Nay, the daytime does not seem sufficient for these indulging insects. *Pieris napi*, Linn., has

been beaten after dark in a state of helpless intoxication from the flowers of the Sallow, and *Vanessa antiopa*, Linn., is also said to have occurred at the same flower in the evening. *Vanessa atalanta*, Linn., is said to have appeared at sugar. As a contrast to these confirmed tipplers, the Argynnidæ and Satyridæ are by no means assiduous flower-lovers, and the same may be said of certain of the Lycænidæ. *Satyrus semele*, Linn., prefers sunning itself on sandy banks, *Pararge egeria*, Linn., loves the broad green leaves of the Elm, whilst *Thecla rubi*, Linn., never strays far from its native Birch.

In certain of the Sphinges, or Hawk-moths, the tongue reaches a great development, and *Sphinx convolvuli*, Linn., probably possesses the longest organ of this description among European insects. Such of the Sphinges as fly by day are all flower-lovers; and the Humming-Bird Hawk-moth (*Macroglossa stellatarum*, Linn.) darts from flower to flower from early morn till late at night. So swift are the movements of this insect that it is almost impossible to catch it whilst on the wing. Chœrocampa is also a day-flying, flower-seeking genus; but of this I cannot speak from personal experience. The Smerinthi, on the other hand, are much slower in flight, and do not appear to go to flowers.

It is, however, among the more widely-distributed Noctuæ, the true "night-hawks," that we must search for the insects likely to be of the greatest service to plants in the matter of cross-pollination, and in practically the whole division the tongue is well developed. Yet here, nevertheless, we meet with genera that seldom or never seek nutriment of any description in the winged state, and among these, judging only from my acquaintance with the few species occurring in this district, I would put Acronycta, Tapinostola, Polia, and Anarta. I was inclined also to range on the same side certain species of Leucania, as *L. pallens*, Linn., and *L. impura*, Hüb.; for I have often worked in localities where these two species are common, and where flowers are also abundant, without having seen the Moths approach the flowers. Other entomologists have had apparently a different experience, and these two species of Leucania must be placed among honey-bibbers.

In the genus Plusia the nectar-sipping habit reaches its greatest development. These beautiful Moths, with their metallic glancing

wings, can only be placed second to the Bees in the constancy of their affections for flowers. *Plusia gamma*, Linn., flies both by day and in the evening, and *Plusia iota*, Linn., shows itself less frequently in the sunshine, and the other species are evening fliers only. The Plusias differ from most other Noctuæ in that they often sip nectar while hovering on the wing, never remaining long at one flower. If they do settle, they are ready to start off on the least motion of the observer. The plants which I have found most attractive to Moths are :—

Wild Flowers.—*Lychnis diurna*, Sibth.; *L. Flos-cuculi*, Linn.; *L. vespertina*, Sibth.; *Anthyllis Vulneraria*, Linn.; *Rubus* (sp. ?); *Potentilla Comarum*, Nestl.; *Hedera Helix*, Linn.; *Sambucus nigra*, Linn.; *Lonicera Periclymenum*, Linn.; *Scabiosa Succisa*, Linn.; *Senecio Jacobæa*, Linn.; *Cnicus arvensis*, Hoffm.; *Centaurea nigra*, Linn.; *Thymus Serpyllum*, Fr.; (?) *Urtica dioica*, Linn.; *Salix*.

Garden Flowers.—Viola, Tropæolum, Sweet William.

Of these flowers two are green, two white, five yellow (including Sallow), seven red or purple, and two blue; and the forms of the flowers are as variable as their colours, ranging from very highly-specialised, long-tubed forms, like Lychnis and Lonicera, to the very shallow cups of the Ivy. The Ivy, Ragwort, Sallow, and Sweet William probably attract more species and greater numbers than all the others put together.

Flowers which open in the evening are usually white, or, at any rate, very pale in colour; and from this fact some have argued that white being so conspicuous in the dark, these flowers have developed it in order that insects might perceive them the more readily. Conspicuousness, however, instead of attracting, may repel dark-coloured insects, such as are the majority of the night-flying Moths. When a lepidopterist goes out "sugaring," he takes very good care not to spread his mixture on the side of the tree which is towards the light, knowing that if he did so he would not see an insect. Moreover, all night-flowering plants, in addition to a copious supply of nectar, are possessed of a singularly sweet and agreeable aroma. May this superabundance of sweets not counteract a weakness—their conspicuousness?

Let us take the two plants which stand first on the list—*Lychnis diurna*, Sibth., and *Lychnis Flos-cuculi*, Linn., and compare them

with the night-flowering white species, *Lychnis vespertina*, Sibth. *Lychnis diurna*, Sibth., is usually to be found in shady places—banks of rivers, woods, etc. *L. Flos-cuculi*, Linn., ordinarily prefers a somewhat damper soil. The habit of *L. vespertina*, Sibth., is the same as that of *L. diurna*, Sibth. Now Sir John Lubbock's argument is that the red species are fertilised by Butterflies, and the white species by Moths. But in the West of Scotland we have no wood-frequenting Butterflies; consequently, when growing in woods, *Lychnis diurna*, Sibth., would stand a very poor chance of being fertilised. True, *Plusia gamma*, Linn., flies by day, but then it only flies for a short time compared with the flowering season of *Lychnis diurna*, Sibth., and the Moth does not penetrate so far into the wood as the plant. If, then, *Lychnis diurna*, Sibth., were dependent on day-flying species for fertilisation, it would necessarily tend to decrease in numbers, especially in wooded situations. On the other hand, *Lychnis vespertina*, Sibth., which does not differ in habit from its red relative, has apparently in our neighbourhood all the advantages—conspicuousness, plenty of nectar, an exceedingly agreeable fragrance, and many species of night-flying insects passing in all directions. Why should it not flourish and increase? Yet *Lychnis diurna*, Sibth., is an exceedingly common plant even in woods, and *Lychnis vespertina*, Sibth., is unquestionably a rare one.

The truth is, *Lychnis diurna*, Sibth., is not fertilised by Butterflies, but by Moths during the evening and night, and the same holds good of *Lychnis Flos-cuculi*, Linn., though neither species possesses a distinct smell, nor is in the least conspicuous. I have myself taken five species of Plusia at *Lychnis Flos-cuculi*, Linn.—*Plusia gamma*, Linn., *P. iota*, Linn., *P. pulchrina*, Haw., *P. chrysitis*, Linn., and *P. festucæ*, Linn.—and all these, with the exception of *P. festucæ*, Linn., at *Lychnis diurna*, Sibth. The genus Dianthœcia is also said to be very fond of these plants, and they are also frequented by such common and widely-distributed species as *Mamestra brassicæ*, Linn., *Apamea basilinea*, Fb., and *A. gemina* (Hüb.). I did on one occasion, at Torrance of Campsie, try the flowers of *Lychnis vespertina*, Sibth., for Moths without seeing any, but the plants were so few in number that this did not constitute a fair test. Unfortunately, *Lychnis vespertina*, Sibth., grows no longer at the place named.

While I am on this part of the subject, I may as well refer to the Sweet William, which belongs to the same family as the Campions. Mr. E. C. Eggleton, now one of the oldest of Glasgow entomologists, has for many years planted large beds of this flower in his garden at Fintry, Stirlingshire, principally on account of its attractiveness to Moths, especially to the species of the genus Plusia. By this means he has been able to obtain a considerable series of the rare but widely-distributed *Plusia bractea*, Fb. It has been his experience that the Plusias and other dark insects carefully avoid the white varieties of Sweet William, and that the dark-purple varieties, that is the most inconspicuous, appeal most strongly to their tastes. On the contrary, the Shark Moth (*Cucullia umbratica*, Linn.), which is light in colour, seems to make instinctively for the white flowers. It would not, however, pay the plants to cater for such light-coloured species, for they represent only a very insignificant minority of night-flying Moths, and are, besides, very inconstant in their attentions to flowers.

I shall now take the other plants as they stand on the list.

Anthyllis Vulneraria, Linn., appeared to be a great favourite with *Macroglossa stellatarum*, Linn., in Wicklow. I have not noticed that any other species are attracted to it. In all probability, however, this is the "kind of vetch" to which reference was made in the beginning of this paper.

The Bramble (*Rubus*) is one of the few white flowers which seems to be attractive to Moths. I have taken the following insects at Bramble blossom at night:—*Mamestra brassicæ*, Linn., *Apamea oculea*, Linn., *Triphœna comes*, Hüb., *Calocampa vetusta*, Hüb., and *Calocampa exoleta*, Linn. But the behaviour of Moths visiting Bramble, is altogether different from that which they assume towards other flowers. Instead of flying directly to the blossoms, they sneak along beneath the leaves and thorns, appear for a minute against the white ground, and vanish.

Marsh Cinquefoil (*Potentilla Comarum*, Nestl.) is a very peculiar plant. Sometimes insects fairly swarm round it, at other times scarcely a Moth is to be seen. *Apamea basilinea*, Fb., appears to be particularly fond of it, and it is likewise visited by *Xylophasia monoglypha*, Hufn., Linn., *Mamestra brassicæ*, Linn., *Apamea gemina*, Hüb., *Miana fasciuncula*, Haw., *Triphœna*

pronuba, Linn., *Hadena oleracea*, Linn., and *Euplexia lucipara*, Linn. Some of these Moths rest on the flowers and suck the sweets at their leisure.

Of the Ivy I have not had much experience; but among English entomologists it has a great reputation. Here is what Sir John Lubbock says regarding it:—

"Araliaceæ.—The only European species belonging to this order is the common Ivy (*Hedera Helix*). It is proterandrous, and is much visited by flies and wasps." Nothing is said of the great numbers of Moths that nightly visit the plant while in blossom. I read recently in the *Entomologist* the grumble of one collector who had only managed to obtain a dozen *Cerastis spadicea*, Hüb., and half-a-dozen each of *Cerastis vaccinii*, Linn., and *Scopelosoma satellitia*, Linn., as the result of an evening's work at Ivy. Only 24 insects, and in the month of October!

In all my experience of Moth-collecting, I only once found a plant which does not yield nectar, attracting insects. That plant was the Elder, *Sambucus nigra*, Linn. In Wicklow, in 1892, I worked some bushes of Elder which grew on the garden wall of a ruined cottage, situated on the coast, two miles to the south of the town. The perfume of the flowers could be felt for a considerable distance. Noctuæ (principally of two species, *Noctua c-nigrum*, Linn., and *Hadena dentina*, Esp.) were flying about the flowers in considerable numbers, even occasionally resting on them. Some nights later, at Drogheda, I tried Elder blossom without seeing a single Moth, and I have tried it repeatedly since with the same result.

Honeysuckle (*Lonicera Periclymenum*, Linn.) is undoubtedly attractive, and emits a very sweet smell in the evening. Like the Bramble, it is difficult to work, owing to the situations in which it grows, and I can only speak with certainty of two species visiting it, viz., *Mamestra furva*, Hüb., and *Thyatira batis*, Linn. The occurrence of the latter species at flowers is a little curious, for all its affinities are with the Bombyces, and the tongue does not appear to be very well developed. Although I only mention these two, yet I have seen many insects, evidently of many different species, at Honeysuckle flowers.

By shining the lantern on the umbels of *Heracleum Sphondylium*, Linn., while returning late at night from sugaring

expeditions, I have repeatedly observed *Apamea oculea*, Linn., lying on the flowers in a helpless state of intoxication.

Among plants which are very attractive to Noctuæ the most noteworthy are the Ivy, Sallow, Field Thistle, and Ragwort. Moths which have been sucking the juices of any of these flowers for any length of time are unable to fly, and simply tumble over when touched. It is probable that more species of insects have been recorded as occurring at the Ragwort (*Senecio Jacobœa*, Linn.), than at any other plant in the British Flora, and I will only mention a few of the species I have observed myself—*Agrotis vestigialis*, Hufn.; *A. tritici*, Linn.; *A. segetum*, Schiff.; *Miana bicoloria*, Vill.; *M. fasciuncula*, Haw.; *M. literosa*, Haw.; *Hydræcia micacea*, Esp.; *H. nictitans*, Bork.; *Charæas graminis*, Linn.; *Caradrina quadripunctata*, Fb.; and *Triphœna fimbria*, Linn. On the other hand, the more showy *Senecio aquaticus*, Huds., does not seem to attract Moths at all.

It is possible that a plant of Ragwort or Field Thistle may occasionally receive the pollen of another individual, but from the habits of the insects frequenting these plants it is almost certain that pollination is effected mostly between the separate florets of the flower-head. Neither Bee nor Moth will leave the heads of either plant till every floret has been probed, and it usually happens, especially with the Moths, that the visitor is unable to proceed further.

Cnicus arvensis, Hoffm., is much more popular by day than by night, and it is much sought after by such species as *Celæna Haworthii*, Curt., *Miana fasciuncula*, Haw., *Hydræcia nictitans*, Linn., and *Charæas graminis*, Linn. I have likewise taken *Cidaria pyraliata*, Bork., on thistle-heads, but the Geometer carries his wine better and keeps his head. *Scabiosa succisa*, Linn., and *Centaurea nigra*, Linn., are well looked after by *Plusia gamma*, Linn., and the heads of the Centaurea are often quite covered by one of the Pyralides (*Scopula lutealis*, Haw.), sometimes accompanied by a nearly-allied species, *Pionea forficalis*, Linn. *Thymus Serpyllum*, Fr., is productive of Noctuæ after dark. I have obtained in this way *Axylia putris*, Linn., and *Miana literosa*, Haw.

In placing the Nettle in the list of flowers attractive to Moths, I have marked it with a point of interrogation. But there can

be little doubt that the flowers of the Nettle, although they are specially fitted for wind fertilisation, do attract insects of more orders than one. I have found the flowers literally covered with small Beetles, and in the evening have netted among Nettles—*Halia wavaria*, Linn., *Noctua plecta*, Linn., *Noctua xanthographa*, Fb., *Agrotis exclamationis*, Linn.; etc. Mr. A. Adie Dalglish informs me that *Scopula lutealis*, Haw., also visits Nettle flowers. I have not mentioned such species as *Plusia chrysitis*, Linn., and *Habrostola tripartita*, Hufn., which feed on Nettle in the larval state, and may simply visit the plant for ovipositing.

Of the Sallow I need say little. Its attractiveness, and the insects which frequent it, are already known to all entomologists. The nectar, as I have already said, is intoxicating, and would seem to impede rather than to help "the grand object which these visits are destined to effect."

All my experience of Moth-collecting leads me to the conclusion that with these insects colour is a matter of little importance as an attraction. Given nectar, be the flower with or without smell, no matter how inconspicuous it may be, the Moths will find their way to it; and smell alone, as in the case of the Elder, may bring them. But everything goes to prove that, in respect of attractiveness to Moths, white or conspicuous flowers are hindrances, and not helps.

Narrative of a Cruise in Loch Fyne, June, 1899.

By JOHN PATERSON and JOHN RENWICK.

[Read 27th June, 1899.]

BIRDS, ETC.—On the evening of 6th June this year a party representing the Society, and consisting of Messrs. John Robertson, John Fleming, Hugh Boyd Watt, and the writers, joined Mr. Bain and Mr. John Downes in the former's yacht, the s.s. "Romany," at Craigmore, the intention being to have a three days' cruise in Loch Fyne, and to visit a number of islets in its waters. We

proceeded from Craigmore by the Garroch Head to Skipness, where we lay for the night. Off the Cock of Arran we noticed, in passing, a flock of Gulls with a few rock-birds among them, the whole of them apparently greatly excited, the Kittiwakes (*Rissa tridactyla* (Linn.)), whenever they were a foot or two above the surface of the water, folding their wings and plunging incontinently back, becoming for a few seconds completely immersed, while the larger Gulls contented themselves with harassing their more active congeners, and attempting to rob them of part of their prey. On arrival at Skipness we went ashore, and visited the remains of the Priory there. Within the walls of the church, and placed in a crevice, a Mistle-Thrush (*Turdus viscivorus*, Linn.) was sitting upon newly-hatched young. She remained sitting in full view of all our party for two or three minutes. This is quite a notable site for the Mistle-Thrush to occupy. About Skipness Castle we found no Swifts, but any deficiency in this respect was compensated for by the Starlings (*Sturnus vulgaris*, Linn.), of which two or three hundred were roosting in a clump of Rhododendrons. Mr. Robertson saw a Woodcock (*Scolopax rusticola*, Linn.) before we left. Next morning we went ashore early to do some photographing and explore one of the glens. Leaving the photographers about the Castle and Priory, we took a turn through the glen at the Castle. Here we saw a Roe-deer (*Capreolus caprea*, Bell). Reaching the road where it crosses the stream, and following it for a quarter of a mile, we were pleased to find, in a wood skirting one side of the road, several Tree-Pipits (*Anthus trivialis*, Linn.) in song, and Lesser Redpolls (*Linota rufescens* (Vieill.)) passed overhead twice. On the moor-ground, just above the cultivated land, we found the Whinchat (*Pratincola rubetra* (Linn.)), the only time we saw it during our trip. Getting aboard and under weigh, we were soon at the Skate, or Sgat Mohr, a rocky islet on the east side of Loch Fyne. Here we found four nests of the Red-breasted Merganser (*Mergus serrator*, Linn.) placed among rushes and old clumps of Brake-ferns, containing respectively eight, nine, and, two of them, ten eggs. One of the nests was placed under a clump of old brakes that had been blown over by the wind, forming a natural cushion, under the shelter of which the nest was placed.

Other two were placed within a couple of feet of each other, under the same clump of withered brakes. The Wood-rush (*Luzula maxima*, DC.) grows luxuriantly on some of the islets in Loch Fyne, and we found its leaves favoured by the Red-breasted Merganser for constructing its nest, a material said to be used invariably by the Golden Eagle for this purpose. On Sgat Mohr we also found a few pairs of each of the following species nesting:—The Rock-Pipit (*Anthus obscurus* (Latham)), Oyster-catcher (*Hæmatopus ostralegus*, Linn.); Common Gull (*Larus canus*, Linn.), Common Tern (*Sterna fluviatilis*, Naum.), and or Arctic Tern (*Sterna macrura*, Naum.). Besides the species named, the only bird seen was a Red Grouse, but when flushed it quickly crossed to the mainland. There were many rat-holes in this island, and the presence of this species in numbers would perhaps account for the paucity of Terns nesting here compared with some of the other islets visited later. Indeed, the first Tern's egg we found was an empty one under a large stone, to which place it had doubtless been brought by a rat.

But a short distance from Sgat Mohr lies Eilean Buidhe—an islet which presented a very animated appearance from the Terns and Gulls which rose in great numbers as we approached. Of Terns' nests very many were seen, about seventy pairs probably nesting here. A great variety of situation was chosen, but most of the nests were found where the rock was pretty bare, just allowing sufficient earth and vegetation in a little hollow as a bedding. When these conditions were not complete and a bare hollow in the rock was available, the deficiency was generally supplied by various means. The Sea-Pink (*Armeria vulgaris*, Willd.) and the Orange-stain Lichen were the only plants enlivening some of the grey rocks, and in several cases the flowers of the former were largely used as a bedding for the eggs. In one instance a hollow was filled up with these flower-heads exclusively, and an egg laid thereon. In this case we carefully removed the eggs and counted the flowers, to find that over two hundred and twenty had been used. This nest, with its egg, in the bright sunlight, was an object of great beauty. [Pl. XI.] We were unable to satisfy ourselves as to the proportions of the two species of Tern here; Mr. Robertson thinks, however, that there were but few Arctic

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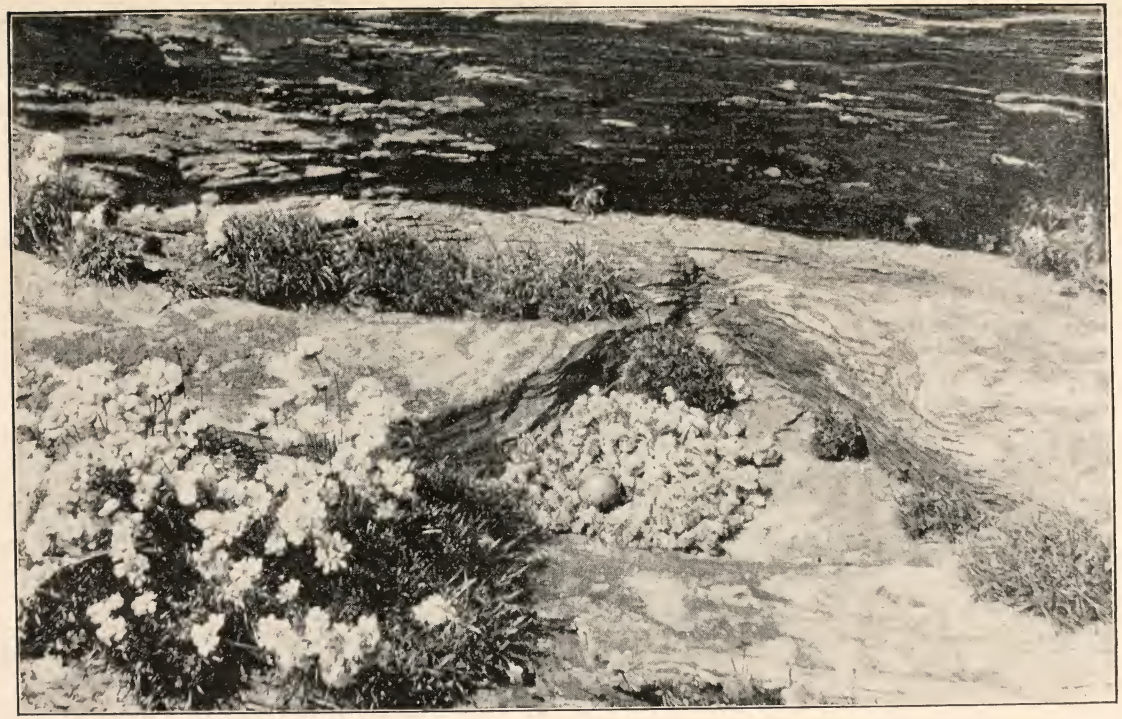

From Photo. by *John Downes.*

TERN'S NEST, COMPOSED EXCLUSIVELY OF FLOWERS OF THE SEA-PINK (*Armeria vulgaris*, Willd.).

Terns, and that they began to predominate only when Glas Eilean was reached. On Eilean Buidhe about twelve pairs of Common Gulls (*Larus canus*, Linn.) were nesting. No evidence of the presence of any land-mammal was seen.

Proceeding northward, we next came to Eilean Buic. Here, as on the other islands visited, the Oyster-catcher and Rock-Pipit were conspicuous; there were, however, but few Common Gulls nesting here, and only a solitary nest of a Tern with one egg was found. A Red Grouse when disturbed found its way to the mainland, and a Common Sandpiper was seen in the vicinity. A pair of the Common Sheld-Duck (*Tadorna cornuta* (S. G. Gmel.)) was seen in this neighbourhood. Vegetation was more varied here than on any of the islets yet visited.

From Eilean Buic we went in the ship's gig to Caisteal Aoidhe (the "Robber" Island), which, indeed, is only an island at high water. There is a fine example of a vitrified fort here, and the evidences of vitrifaction were examined with much interest. This islet has no attraction for the ornithologist; but it yielded one species seen nowhere else during our trip, the Twite (*Linota flavirostris* (Linn.)), and we came upon an Oyster-catcher's nest with two eggs.

We now proceeded to the west side of the loch, and paid a visit to Glas Eilean, opposite Otter Spit. Although we had apparently bade good-bye to the Common Gull as a nesting species, the Common and Arctic Terns were more numerous here than on any of the other islands yet visited. The colony here must number not less than a hundred pairs—one mutilated dead bird found was an undoubted Arctic Tern. The Common Sandpiper (*Totanus hypoleucus* (Linn.)), which occurred here, was an addition to the list of land-birds seen on the islets visited.

We anchored at Otter for the night and had a turn ashore, but saw nothing of interest during our brief visit. Thursday morning found us *en route* for Fraoch Eilean and Eilean Aoghainn (or Aoidh), but on the way a shout arose that the Sea Serpent had been seen on the port bow—an animal showing a tall, thin, arched fin, having been descried. We were all on the lookout at once after this alarming summons, but the only "leviathan afloat" that we could discover was a Bottle-nosed Whale (*Hyperöodon rostratus* (Müll.)). On Fraoch Eilean fifty to sixty pairs

of Common and Arctic Terns were nesting, and dead examples of both species were found, one in each case. The heather on this, as its name signifies, Heather Island, was much appreciated by the Red-breasted Merganser as cover, a nest with eight eggs and another with three, the latter quite covered over with heather *débris*, being found, while old nests and unoccupied nests of this species were also found. Lamb Island, or Eilean Aoghainn, closely adjoining Fraoch Island, was another nesting site of the Red-breasted Merganser, Brake-ferns again supplying the cover. One nest had been rifled of its contents by the Carrion-Crow (*Corvus corone*, Linn.). Several of these black rascals were seen about the island during our visit, and they were again seen there on our return down the loch on the following day. We found a Red-breasted Merganser's nest with ten eggs covered with down, and one with the extraordinary number of sixteen eggs. [Pl. XII.] In its vegetative aspect this was the most attractive island we had yet visited. Rock-Pipits abounded, and a pair of Common Sandpipers was pretty certainly nesting on it. Rabbits had established themselves here, and a few pairs of Terns only.

From Lamb Island we proceeded to the head of the loch. Coming down we landed at Dundarave Castle, noting here the Spotted Flycatcher (*Muscicapa grisola*, Linn.), Redstart (*Ruticilla phœnicurus* (Linn.)), Wood-Wren (*Phylloscopus sibilatrix* (Bechst.)), and Tree-Pipit (*Anthus trivialis* (Linn.)). Here, as at Skipness Castle, we looked in vain for the Swift, a bird quite characteristic of the numerous old castles in Ayrshire, as long since pointed out by Gray. Resuming our journey, we reached Inveraray, and here we had a walk through the policy and ascended Dunaquaich. We were naturally very much delighted with the great woods around the castle, and our visit being coincident with the flowering of the Wood Hyacinth, we saw them with great sheets of blue in the open spaces, and a "hyacinthine haze" . . . "spreading round the roots" in the recesses of the woods. We came on an interesting pinetum on our way up Dunaquaich, but such collections seem to have fallen out of fashion. They have in a sense overstood their market, and this one had the neglected appearance which we have come to associate with them. We had not much time to spare, but we took the following measurements of trees which seemed to us to

From Photo. by *John Fleming.*

NEST OF THE RED-BREASTED MERGANSER (*Mergus serrator*, Linn.), WITH SIXTEEN EGGS.

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be in some particulars remarkable, chiefly on account of their size :—

Scotch Fir (*Pinus sylvestris*, Linn.), south-west of Castle, 14 ft. 2 ins. in circumference at 5 ft. up on south-west side of tree. Bole, 35 ft. to 40 ft.

Ash (*Fraxinus excelsior*, Linn.), south of byres, west of Castle (the south-west tree of a pair), 13 ft. 7 ins. at 5 ft. on side next the road. Bole, 45 ft. to 50 ft.

Beech (*Fagus sylvatica*, Linn.), east of building above mentioned, 16 ft. 9 ins. at 5 ft. Bole, 11 ft.

Beech (*Fagus sylvatica*, Linn.), in north corner at south-west end of long walk, 17 ft. 9 ins. at 3 ft. 10 ins., south. Bole, 8 ft.

Spanish Chestnut (*Castanea vulgaris*, Lamk.), north of first Beech mentioned above, 20 ft. 7 ins. at 5 ft. on east side. Bole, about 30 ft.

Sequoia sempervirens, Endl., near lime-kiln, 8 ft. 2½ ins. at 5 ft. on side next road to Dunaquaich.

Here we noted the Redstart, Wood-Wren, and Tree-Pipit again, and if in our brief visit we failed to find the Garden-warbler and Chiff-chaff, we had some compensation in coming on the Blackcap Warbler (*Sylvia atricapilla* (Linn.)), one bird of this species being heard and seen that evening, and again on the following morning, in some oaks near one of the gardens.

The Common Heron (*Ardea cinerea*, Linn.) is a conspicuous element in the bird-life of the place. Owing to the existence of a Heronry in the woods, the birds can be seen on their nests from the town or the park of the Castle with a binocular, and they are constantly in sight passing in the bay. In the still air of a beautiful evening also, we were able to note from the deck of the "Romany" that the Tawny Owl (*Syrnium aluco* (Linn.)) is not uncommon in the district, as we heard it hooting about St Catherine's and in Glen Shira.

On Friday morning we went ashore to have a walk through the celebrated Beech avenue, and we took the chance of measuring one of the largest of the Beeches that we saw. The one referred to was situated at a sharp turn in the avenue, and it measured 17 ft. 9 ins. at 3 ft. 10 ins. on the south side of the tree. The bole was short, say about 8 feet. Going on board again we

resumed our journey, proceeding down the loch, and visiting Liath Eilean on the way. The Red-breasted Merganser was nesting here, but the only two nests in which down was found had been robbed. Rock-Pipits and Oyster-catchers were conspicuous, and young of the Common Sandpiper were got. The common Sheld-Duck was again seen as we approached this island.

We proceeded down the loch without further incident, but a Skua too far off to be identified was seen.

We had seen young of the Oyster-catcher, Common Gull, Rock-Pipit, and Common Sandpiper, but in no instance did we see young of either of the Terns or of the Red-breasted Merganser. The Terns' nests had chiefly two eggs, but a dozen nests having three eggs each were seen. The Merganser's were in all states, from a nest with three eggs, covered over with heather *débris*, to nests with a full complement, completely covered with down. Many photographs of nests were taken. It only remains to say that throughout the trip the most delightful summer weather prevailed.

MOLLUSCA.—List of Land-shells collected by Mr. Hugh Boyd Watt, named by the Rev. G. A. Frank Knight, M.A., and authenticated by Messrs. Thomas Scott, F.L.S., and Robert Standen, Curator of the Conchological Society of Great Britain and Ireland.

Amalia sowerbyi (Fér) [= *Limax marginatus*, Jeffr.], from Eilean Aoghainn.

Hyalinia cellaria (Müll.), young, Glas Eilean, Otter.

H. alliaria, var *viridula* (Jeff.), Glas Eilean.

Helix rotundata, Müll., Glas Eilean and Eilean Aoghainn.

H. nemoralis, L. 12345, Glas Eilean and Eilean Aoghainn.

„ „ (12) 3 (45), Glas Eilean.

„ „ (12) 3 (45), Glas Eilean.

H. nemoralis, var. *roseolabiata*, Taylor (a very fine specimen), Liath Eilean near Kilmory.

H. nemoralis, var. *albolabiata*, Von Mart., Glas Eilean.

H. nemoralis, var. *rubella*, Moq., Glas Eilean.

H. nemoralis, var. *libellula* (Risso), 00000, Eilean Aoghainn.

H. arbustorum, L. (scarcely full grown), Glas Eilean.

Pupa cylindracea (Da Costa) [=*P. umbilicata*, Drap.] Eilean Aoghainn, dead.

Clausilia perversa (Pult.), Eilean Aoghainn.

C. perversa, var. *tumidula*, Jeff. Glas Eilean and Eilean Aoghainn.

GEOLOGY, ETC.—The first four islands on which we landed, Sgat Mohr (the big skate), Eilean Buidhe (the yellow isle), Eilean Buic (buck isle), and Caisteal Aoidhe (said to mean Hugh's castle), or the "Robbers' Rock," an island only at half-tide, belong to a group of rocks which in the Cowal mainland consists of albite schists, schistose greywackes, and other mica-schists very highly metamorphosed. Mr. W. Gunn, in the Geological Survey Memoir on Cowal, page 196, says—"Moderately fine grey micaceous schist, full of quartz veins and much plicated in places, forms the island of Sgat Mohr. . . . ." "A N.N.E. crush crosses Sgat Mohr." Two specimens are exhibited from this island, both of quartzose micaceous schist, one of them very much plicated, and with quartz veins. The crush of which Mr. Gunn speaks, is presumably the cause of a depression which runs across the island, and is seen continuing in the same direction on the mainland—the rock on each side of the crush being more broken, and thus more readily worn away by rain, frost, etc. Next are shown two specimens of mica-schist from Eilean Buidhe, which lies almost in the centre of an "anticline of foliation." From Caisteal Aoidhe there is exhibited a piece of mica-schist, or quartzose muscovite biotite schist, probably a metamorphosed greywacke. From the vitrified fort on this peninsula several specimens are exhibited, showing pieces of rock fused together.

We do not know anything of the history or traditions of this fort, but the name "Robbers' Rock" suggests that it may be a relic of its possession by invading strangers, such as the Norsemen, whose galleys frequented these coasts seven to ten centuries ago, and of whose presence we have enduring evidence in the name of the place where we lay on the first night of our cruise—namely, Skipness, or ship nose or point, and in that of the bay behind Sgat Mohr, Asgog, said to be *askr vik*, or ships' bay.

The other four islands which we visited, belong to a series of

rocks composed of soft calcareous schists, with subordinate harder quartzose schists. The latter are most fully developed towards the south-west on the Kintyre coast, between Stronchullin and Slatefield, decreasing generally to the north-east. The islands belong to the latter zone. From Liath Eilean (the light-blue isle), near the mouth of Loch Gilp, we exhibit a piece of quartzose micaceous schist, showing false bedding, or perhaps foliation lines, and with an introduced vein containing chlorite. The mass of this island consists of epidiorite, an altered basic igneous rock, probably intrusive. It is crossed by a dyke of olivine basalt, an unaltered igneous rock running north-west and south-east, probably of Tertiary age, a specimen of which is shown. A piece of dolomite, a crystalline limestone from a vein, is shown, and a bit of quartzite from a block, none of it seen *in situ*. From Glas Eilean (the grey isle), north of Otter Spit, we show a piece of quartzite and two pieces of quartz schist, one of them much folded. The two islands opposite Minard Castle, Eilean Aoghainn (lambs' isle) and Fraoch Eilean (heather isle), seem to be composed entirely of coarse epidiorite. Most of the upper part of Loch Fyne has been hollowed out of the softer rocks of this series.

From the shore, and from the banks of the little burn, to the west of Dundarave Castle, on the north-west coast of the loch, are exhibited several specimens of quartz-schists with calcareous matter in them, one with acute foldings. The knoll on the water-edge, near the castle, doubtless the site of the original "dun," or fort, from which is derived the name *Dun-da-raimh* (rave) = "the fort of the two oars," is composed of fine-grained epidiorite, apparently intrusive, a specimen of which is shown. The epidiorite, being harder than the surrounding schists of sedimentary origin, has resisted denudation better, and so stands up as a knoll.

This knoll and all the islands are more or less smoothed, rounded, and grooved by the action of the mass of ice that in the glacial period filled up Loch Fyne. The directions of the markings run in the line of the loch.

The "spit" of gravel and shingle at Otter (Gaelic, *Oitir*, a projecting ridge or bank in the sea), which divides Loch Fyne into "Upper" and "Lower," may be a moraine re-assorted by water,

but it has more probably been formed by the action of tides and currents.

In the *New Statistical Account* (1844) the minister of the parish of Glassary writes—"There is a remarkable bank formed of sand and debris from the hills on each side of Lochfyne at Ottar. This bank, with the other depositions by which the bed of Lochfyne must necessarily be raised in its level from year to year by the disintegration of rocks, the carrying away of banks, etc., may possibly effect great changes upon the character of the loch above Ottar on some future day, by obstructing the ingress of the tide and converting the upper portion into a fresh-water lake with its river entering the sea; and would it not be worthy of the heritors to take some measure of making such observations on each side of the Ottar, as may be necessary to ascertain the rate of increase of this bank, if any; whether there be a tendency to the formation of a similar bank down on the north side, etc.?"

The run of the current is, we expect, sufficient to keep the channel open, but such observations would be of considerable scientific interest.

The geological structure of the rocks in the neighbourhood of Loch Fyne is very complex. No organic remains have yet been found in them. Their age is not known; they may be Lower Silurian, Cambrian, or even Pre-Cambrian. Those in the Cowal district have been described in the memoir of the Geological Survey, already referred to, published in 1897.

Most of the rocks are evidently of sedimentary origin, but since they were deposited in the seas or lakes of remote times they have undergone great changes, whereby their original structure has been completely altered, and they now present a highly crystalline appearance. Even the igneous rocks apparently intruded into them, and if so, newer than the sedimentary rocks, have been metamorphosed, with the exception of the mica-traps, lamprophyres, and dykes of probably late Carboniferous and Tertiary ages. This metamorphism has perhaps been caused by earth movements on a large scale, whereby the strata forming the crust of the earth have been folded, twisted, and crumpled. These movements have occurred more than once, and the repeated foldings have produced new structures in the rocks. The original lines of bedding have in many cases been almost or

quite obliterated, and new lines of foliation or cleavage superinduced. The rocks are not equally metamorphosed over the whole area. The greatest amount of alteration occurs in the region near the mouth of Loch Fyne, between Sgat Mohr and Caisteal Aoidhe on the east side, and in the corresponding tract on the Kintyre coast to the south-east of Loch Tarbert. Stretching away to the north-east, by the heads of Loch Riddon, Loch Striven, and Loch Goil, is a belt in which the maximum of metamorphism is shown, on each side of what is called the axis of the "anticline of foliation." This anticlinal axis is that mentioned in the report of the Society's excursion, on 25th June, 1898, to Loch Long side, wherein it was stated that the strata at the point where it passes are more altered and twisted than those to the north and to the south. It is an "anticline of foliation," not strictly one of bedding, but rather one "of the early folds that affect the bedding." Before it was formed, the strata had already, by earth movements, been greatly folded, crumpled, and foliated. Those nearer its centre have apparently been covered by a greater thickness of overlying strata, and been subjected to a greater heat than have those farther away. Therefore, as we recede from the centre towards the south-east and towards the north-west, the rocks are less altered. Continued earth movements have afterwards arched up the strata along the line indicated, producing new curvings and foliations. Subsequent denudation has worn off an immense thickness of material, so that the strata along the line of anticline do not show at the surface as a ridge elevated above those on its flanks. In fact, anticlines of ancient date do not usually rise into ridges, but rather tend to be hollowed into valleys, as the weakest part of folded strata runs along this line, the rocks there having been strained and stretched, while at the bottom of a syncline they have been compressed. A good example of such a formation was seen at the Society's excursion to Killin on 19th April, 1897, when it was pointed out that the valley occupied by Glen Dochart and Loch Tay had been hollowed out of an anticlinal arch.

The axis of the anticline in Cowal runs parallel to the great boundary fault which crosses the country in a north-east and south-west direction, cutting off the older Highland rocks to the north-west from the newer Lowland rocks to the south-east.

On the Clyde this fault is seen at Toward, Kilcreggan, Rosneath, and Ardencaple, and it was crossed near Callander on the Society's excursion on the Spring Holiday this year, and in the train on the excursion to Aberfoyle on 24th June.

The outcrops of the various groups of strata along Loch Fyne run in the same direction as the anticlinal axis. The Geological Survey Memoir (p. 85) gives the succession as follows, but we take it from the mouth of the loch upwards, the reverse of their order—

1. "Albite schists, schistose greywackes, and other mica-schists."
2. Green-coloured schists mixed with schistose greywacke and other mica-schists.
3. The Glendaruel or Loch Tay limestone, a coarsely-crystalline marble, and calcareous quartzite.
4. "Alternations of thin-banded mica-schists, commonly garnetiferous, with some limestones and 'green beds.'"
5. "Graphite schists, dark graphitic limestones and quartzose schists intermixed with phyllitic garnetiferous schist."
6. Ardrishaig phyllites, soft calcareous sericite schists, with many outcrops of quartzite schist and some limestones.

These groups represent a downward succession of strata, but which is the oldest and which the newest is not certainly ascertained. On the Loch Fyne side of the anticline the north-west rocks appear to be the newer, but on the Clyde side the south-west rocks seem to be the more recent.

To Group No. 1 belong the first four islands which we visited—Sgat Mohr, Eilean Buidhe (buie), Eilean Buic, and Caisteal Aoidhe. We did not land on any part of the regions where the next two groups occur—namely, "the green beds" and the Loch Tay limestone. At the Society's excursion to Killin, already mentioned, several sections of rocks near the head of Loch Tay, and in Glen Dochart, near the head of Glen Ogle, were examined, showing the Loch Tay limestone overlying hornblende schist. Regarding Cowal, Mr. Clough, in the Memoir (p. 45), says—"The Glendaruel or Loch Tay limestone is perhaps the most readily mapped and best-defined schist in the district." . . . "It is seldom seen without a band of hornblende schist either in or just at the sides of it, or in both positions."

The next two groups are also unrepresented in our exhibits, save by a single specimen of mica-schist from Otter, in Group 4. To the Ardrishaig phyllites belong the rocks at Dundarave and in the four islands above Loch Gilp—Liath Eilean, Glas Eilean, Eilean Aoghainn, and Fraoch Eilean.

For the names of the specimens exhibited we are indebted to Mr. B. N. Peach, F.R.S., H.M. Geological Survey.

Heronries, Past and Present, in the Clyde Faunal Area.

By Hugh Boyd Watt.

[Read 25th April and 29th August, 1899.]

The Common or Grey Heron (*Ardea cinerea*, Linn.) is a resident bird of frequent occurrence in our district in localities suitable for it, sometimes straying within the bounds of the city of Glasgow, [1] but of its breeding-places, in spite of both the ornithological and antiquarian interest which attaches to them, no adequate or detailed account exists. The late Mr. R. Gray, in his published works, refers in a general way to local Heronries; Mr. Henry C. Young, in his "List of Birds which breed in the vicinity of Glasgow," marks the species "R" (rare), and names only Hamilton and Inverkip; [2] and Mr. J. E. Harting, in his account of "British Heronries," names ten (some extinct) in our "Clyde" counties, and further remarks "that many doubtless will be surprised to learn that within the limits of the British Islands, the existence of more than two hundred Heronries has lately been established." [3] This figure, which is altogether an under-estimate, has unfortunately found its way into more than one work on British Birds, including Prof. Newton's *Dictionary of Birds* (1893-6), [4] where Scotland's share of the above number

[1] *Annals of Andersonian Nat. Soc.*, II., p. 47 (1896).
[2] *Fauna and Flora of Clydesdale, &c.* (1876), p. 10.
[3] *Zoologist* (1872), p. 3261. [4] P. 418.

is said to be "more than fifty"; and "nearly fifty in Ireland." Mr. R. J. Ussher, one of the authors of the forthcoming work on the *Birds of Ireland*, has records of more than three hundred places in that country which are supposed to contain upwards of four or more nests;[1] and I have the names of over two hundred nesting localities in Scotland, some of which, however, are deserted, but from certain districts I have no returns or information, so that there may actually be more than the above number of Heronries in Scotland altogether. I may explain that in the course of this paper I shall make what may be called a working use of the term "Heronry," including under it any colony of two or more nests. Prof. Newton points out that when the Heron ceased to be protected, the larger Heronries became broken up, and the smaller though more numerous settlements now in existence are "hardly to be dignified by the name of Heronry,"[2] but with the explanation I have made I shall mislead no one, and the details follow. Standard works on ornithology state[3] that comparatively few large Heronries existed in Scotland, and I know of none now like that which flourished at Shaw, on the Dryffe, about one hundred years ago, where it is said of the Heron, "some hundreds are bred yearly."[4] My impression for a considerable time, as to the *status* of the species in our district, was that individual birds were surprisingly common and abundant in relation to the number of their reported breeding-places, but the ascertained details which follow somewhat modify this impression.

I am indebted to many kind correspondents, whose names are incorporated in my footnotes, for information sent to me at my request, without which assistance I could not have executed my task so thoroughly; but I must express my particular obligation to Messrs. J. A. Harvie-Brown, John Paterson, and Geo. Rose, who all very generously placed at my disposal MS. material which they themselves had collected bearing on the

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[1] R. Bowdler Sharpe: *Hand-Book to the Birds of Great Britain* (1896), III., p. 70.

[2] *Op. cit.*, p. 418.

[3] Yarrell's *British Birds*, 4th ed., IV., p. 167. H. Saunders: *Manual of British Birds*, 2nd ed., p. 367.

[4] *Statistical Account of Scotland* (1795), XIII., p. 580.

subject. I am glad to have this opportunity of acknowledging my indebtedness, and expressing my thanks to all who have assisted me.

Ayrshire.

Beginning in the south of our area, at Glenapp, Herons have seldom been known to nest, and not for many years;[1] and at Lendalfoot, Mr. C. Berry told me (8th April, 1898) that he knew of no Heronry in his district, although the birds coming about were all immature. I consider these negative records, when obtained from reliable sources, worth noting here, even although they only amount to a clearing of the ground, particularly when they refer to localities from which the bird has been reported as breeding. Mr. Berry had heard something of them breeding up about Barrhill, and this rumour probably has reference to Loch Goosey, which, although in Ayrshire, is beyond the Clyde watershed, and drains into the Cree ("Solway"). Mr W. C. S. Fergusson, formerly secretary of the Ayr Natural History Society, knew this Heronry as long as he could remember, and he was often at Loch Goosey; he remembers "some years ago a notice appeared in the papers offering a reward of £20 for information against some party who had robbed the nests."[2] With this token of vigorous protection in mind, it was a disappointment to me when I visited the loch (3rd April, 1899), not to see a single Heron; on the small trees on the island were to be seen what might be two nests, but I was unable to get across to them. There is never likely to have been a large number of nests here, as, while the island is thickly set with trees, mostly Birch, it is of limited area, and the trees are small in size. In the Girvan Valley I know of no Heronry, but in a recent year (1897?) there was one nest at Kilkerran; and some years ago a Heron was shot on its nest, which was placed on the edge of the bank of the River Girvan.[3] Up till about fifteen years ago, a good many Herons built in a wood at Craigengillan (Dalmellington), mostly in Larch trees, but the storms of 1884-85 blew all this wood down, and since then there has been none

[1] Mr. Trevor Eyton's MS. notes.

[2] *In lit.* to Mr. John Paterson, 11th June, 1895.

[3] Mr. R. Kitchin, *in lit.* to Mr. G. Rose, 25th January, 1899.

nesting on Craigengillan[1]; nor do I know of any other nesting locality around Loch Doon, although this is a most likely centre, and the bird is common thereabouts. At Doonside (Ayr) a pond was made eleven years ago, which is bounded on one side by an old wood, and once or twice within the last seven or eight years, Herons have had a nest in an Ash tree, and brought out and reared young ones there. None nested there last season (1898), but as the birds frequent the pond, sometimes as many as a dozen at a time,[2] a hope may be cherished that they will yet settle at Doonside. In Loch Fergus is a small island with the remains of a monastery on it, and the new *Statistical Account* says that "till lately this islet was the site of some fine old trees, and the resort of Herons. But those successors of the monks have long since deserted their haunt, and their memory, like that of their predecessors, has almost passed into oblivion."[3] A foot-note further states that "in a small work entitled *A Summary of the Chronicles of Scotland*, published in 1624, . . . mention is made of 'Loch Fergus, with an isle with many growing trees, where great plenty of Herons resort, with the loch-seal.'"[4] It may be assumed that this was a breeding station. It is the earliest record of a Clyde Heronry I know, and assuming further that it continued in existence between the two dates indicated above, it is also the longest period, as the time covered is over 200 years. At Fullarton (Troon) there is a slight eminence called the Heron Hill, and there in the North Wood, in Scots Firs, Herons used to build in considerable numbers. Early in the present century, some of these trees being cut down, a number of the birds left, but about eight pairs built there every

[1] Mr. W. Herron, *in lit.*, 6th March, 1899.

[2] Mr. W. H. Dunlop, *in lit.*, 16th March, 1899.

[3] Vol. V. (1845), p. 655.

[4] The author of this work, of which there are many editions, is John Monipennie, and the year to which it refers, according to another title quoted by Gray in his *Birds of the West of Scotland*, is A.D. 1597. Of Monipennie little or nothing is known, but Mr. P. Hume Brown (author of *Scotland before 1700 from Contemporary Documents*, 1893) kindly informs me, in reply to my inquiry, that his impression is that in what Monipennie relates of the Scotland of his day he writes in perfect good faith (*in lit.*, 26th August, 1899). The Loch Fergus Heronry seems thus to be well enough authenticated.

season until the year of the Tay Bridge storm (28th December, 1879), when all the trees on the Heron Hill were blown down. Since then only two pairs have built at Fullarton, in Scots Firs, distant about 200 yards from one another, and they were at their nests this spring.[1] There are no nests at Dumfries House (Cumnock), Barskimming, Loudon Castle, and Kennox (Stewarton), in spite of reports to the contrary, nor have I any definite old records from these places; but at Lanfine about twenty years ago there was one nest in a very tall thick Spruce Fir in a wood,[2] and many years ago there was also one at Caprington on the top of a high Fir tree.[3] In the Galston, Loudon, and Kilmarnock districts I have definite information that there are now no nests. There used to be a Heronry in the parish of Craigie, but thorough inquiry kindly made on the spot on my behalf by Mr. George Rose, of the Glenfield Ramblers' Society, has failed to find the exact locality or any recollections of a Heronry in the parish. This "lost" Heronry has a remarkable reputation in ornithological literature, being mentioned (1) in Montagu's *Ornithological Dictionary of British Birds* (1831, 2nd ed.), where the editor, James Rennie, says—"I am acquainted with a small one in the parish of Craigie, near Kilmarnock, in Ayrshire, the only one, save that near Ullswater, which I have visited" (p. 257); (2) in an editorial footnote to an edition of Goldsmith's *Animated Nature* (1848),[4] as an example of an extreme rarity in Scotland; (3) in the late Rev. F. O. Morris's *History of British Birds* (1870, 2nd ed.);[5] and (4) in Mr. Harting's "British Heronries," in the *Zoologist* (1872).[6] I much doubt if it was in existence within the last thirty years. Rennie is the only one of the above authors who shows personal knowledge of it, and it must be taken off the record now in any case. An old Heronry at Monkcastle House (Kilwinning) is mentioned both by Morris[5] and Mr. Harting,[6] the latter stating that it was a fine one in 1832, and that

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[1] Mr. M. Arthur, *in lit.*, 14th March, 1899.
[2] Mr. D. Hastings, *in lit.* to Mr. G. Rose, 27th December, 1898.
[3] Mr R. Kitchin, *in lit.* to Mr. G. Rose, 25th January, 1899.
[4] Supplementary Note A., Vol. II., p. 178.
[5] Vol. IV., P. 124. [6] P. 3267.

the birds afterwards moved to near Eglinton Castle, "where the River Lugden falls into the River Irvine" (*sic*).[1] Here they nested for some years, but eventually deserted on account of the persecution to which they were subjected, and the close proximity of the Eglinton Iron Works.[2] I am glad to say that on a recent visit (15th April, 1899) to Eglinton I had the pleasure of seeing a flourishing colony of about thirty nests in the "Craw" Wood there, the nests all being in the tallest Scots Firs, one or two trees having two each, height from ground running up to about 60 feet (estimated). The young were hatched out, as we heard them calling in the nests, and picked up fragments of egg shells and one nestling, which had fallen over, and which was probably about a fortnight old. This means that there were eggs laid in the first week of March. Rooks nest in immense numbers in the same wood, but the two species seem to live in amity, which is not always the case. The Herons have bred in and about this wood for 26 years, nests having also been seen in Beech trees near the foot of the Long Walk, and previous to that they nested in Sourlie Plantation (Eglinton policies). My informant (J. Jeffrey, an old keeper), who recollects the great Eglinton Tournament in 1839, says they were at Sourlie in that year, so they probably did not leave the policies when they deserted the proximity of the iron-works, and both the late and present Earl have protected them. Their numbers, however, seem to keep about the same. Another Ayrshire Heronry named by Mr. Harting is "a large colony at Largs (Earl of Glasgow").[2] The mention of this nobleman identifies the locality with Kelburn Park, which is in the parish of Fairlie, and where, within the recollection of an old man born there 80 years ago, Herons were nesting 70 years back. Formerly they built in Ash and Beech trees; some time ago they removed to their third known nesting-place, which is in two contiguous clumps of mixed trees—perhaps 100 yards between them—mostly Beech, with some Silver Firs, and a few Scots Firs and Larches, situated in an open field. The Silver Firs are the largest trees, but the birds have selected the Beech trees, which are neither tall nor old; and when I saw them (17th March, 1899) there were 25 nests in

[1] The Lugton is a tributary of the Garnock.

[2] *Zoologist* (1872), p. 3267.

all, but some of these appeared to be incomplete. As many as 20 birds were in sight about one tree at the same time, and in one central tree there were seven nests or portions of nests. There is apparently some increase here, as about ten nests each year was given me as the number.[1] This Heronry seems to be somewhat remarkable in its present situation, as the birds have chosen as exposed and open a place as can be found on Kelburn (visible from the public road), and there are larger and denser pieces of woodland near at hand, where concealment could be better found. Two photographs taken by Mr John Fleming, and now put before you, show the appearance of the nests and the trees. The policies of Caldwell are partly in Ayrshire and partly in Renfrewshire, and here, according to a MS. "List of the Birds of Renfrewshire" in possession of the Paisley Naturalists' Society, compiled about the year 1865, the Heron nested,[2] but I have been unable to obtain definite information as to this, or indeed any personal recollection of the fact recorded in the Paisley list. Out of these sixteen Ayrshire localities named now, only three can be said to be presently occupied, and only Eglinton and Kelburn worthy of the name Heronry.

Renfrewshire.

At Ardgowan there is a small Heronry near the shore at the Cuckoo Walk, in Scots Firs and Larches. Formerly the birds nested in some trees near the home-farm, nearer Inverkip, but most of these trees fell during the Tay Bridge storm (1879), and no doubt it is to this locality that records of "Inverkip" refer,[3] and while my furthest back date is 1865, it may be presumed that this Heronry existed anterior to this, and I hope it may long continue to exist. The number of nests seems to have run from six upwards, but never, since the date named, to have exceeded twelve. There were about ten when this Society visited Ardgowan on 21st April, 1894, and the young were then hatched out.[4] Further up the Clyde, at

[1] Mr. J. Menzies, *in lit.*, 3rd March, 1899.

[2] *Fide* Mr. A. Stevenson.

[3] Paisley MS. (1865); *Zoologist* (1872); and *Fauna and Flora of Clydesdale, etc.* (1876).

[4] *Trans. Nat. Hist. Soc. Glas.*, IV. (N.S.), p. 123.

Erskine, is a nesting locality which has some interesting associations, and which is the nearest spot to Glasgow where we can now expect to see a Heron's nest, but I am afraid, at the most there have not been more than two nests annually for the last few years. Part of the wood bears the name of the "Heron Green," and that there was a flourishing colony is borne out by the following passage from the new *Statistical Account* [1] of Erskine (dated August, 1840, and April, 1842)—"In the woods at Erskine, which overhang the Clyde, opposite the old Roman fortress of Dunglass, there is a large Heronry, which has existed there for a great length of time, and which is the more interesting, as it is alleged, there are only one or two more to be found in Scotland. It is a fine sight to observe these noble birds fishing in the river at ebb-tide, and their success may be estimated from the fact, that the walks under their nests are often strewed with flounders and other fish, which they have not been able to use." This fine sight has departed, I fear, for ever. John Wolley, the great oologist, seems to have known this colony, as there is this entry in his Egg Books (MSS.?) "1850. Heronry on Lord Blantyre's estates on Clyde;" [2] and Mr Harting mentions it as existing "in aged and lofty trees," [3] although he puts Erskine under Dumbartonshire. Mr. W. A. Donnelly informs me that within the last thirty years there were about twenty birds nesting not far from the mansion-house in Ash, Elm, and Sycamore trees. In 1890 (3rd May) I first saw Herons here, and was informed that two pairs nested. I had much the same report for last year (1898).[4] The contiguous parish of Inchinnan at the time (1845) of publication of the new *Statistical Account* possessed a Heronry "on some high fir trees in Park wood, adjacent to the Newshot isle in the Clyde," [5] but of this I have no further information, nor do I know when it became extinct. Of Castle Semple a similar story to the Erskine one has to be related, and a like fate chronicled, for it is doubtful if one pair of Herons now nests there.[6] The present keeper (G. M'Arthur), whose recollec-

[1] Vol. VII. (1845), p. 505.

[2] Mr. J. A. Harvie-Brown's "Clyde" file, per favour of Prof. A. Newton.

[3] *Zoologist* (1872), p. 3267.

[4] Mr. C. Hogg, *in lit.*, 14th January, 1899.

[5] Vol. VII. (1845), p. 117.

[6] *Trans. Nat. Hist. Soc. Glas.*, IV. (N.S.), p. 363.

tions go back to 1872, has known in one season 12 or 14 occupied nests at one place. According to Mr. Harting, in 1871 they were in tall Spruce Firs, [1] but they have been built in many different clumps of trees. The Herons have had Rooks as neighbours, and have been ousted by the smaller bird on occasion; but the chief cause of their decline is the manner in which they have been shot down outside the estate, although protected within. In 1896 there was only one nest near the fog-house, and I fear it is a lost colony, although last year there was also thought to be one nest.[2] A nest was reported to have been found at Barrcraig Meadows, Beith, but apparently this is an error.[3] In 1897 I first heard a report that a pair of Herons nested in the woods at Johnstone Castle, and in 1898 two pairs were found, and one pair is also said to nest in the parish of Houston.[2] This completes my tale of Renfrewshire Heronries, as the remainder of the county is covered by the statement of Messrs. John Paterson and John Robertson in their "List of the Birds of East Renfrewshire"—"we do not know of the Heron breeding in this district," [4] and this I can only substantiate.

Lanarkshire.

In this county the largest existing Heronry I know of is at Douglas Castle, where on Spruce Firs, on an island in the North Loch, there were about a dozen nests in 1895. This colony seems to have been founded about 1870, up to which year there was also "an old-established Heronry on large Spruce Firs in Glespin Wood, Douglas,"[5] but of the fate of this Heronry I know nothing. In the next parish (Crawfordjohn), at Gilkerscleuch, there was, about 100 years ago, on trees, "an extensive heronry, but in the course of time, and after many severe contests with their multiplying foes, the herons were killed or dispersed, and the victorious rooks occupied their place."[6] In

[1] *Zoologist* (1872), p. 3269.
[2] Mr. C. Hogg, *in lit.*, 14th January, 1899.
[3] Mr. M. Barr, *in lit.* to Mr J. Paterson, 8th November, 1896.
[4] *Annals Scot. Nat. Hist.* (1895), p. 227.
[5] *Zoologist* (1872), p. 3268.
[6] *N.S.A.*, VI. (1845), p. 500.

Crawfordjohn there is a story, dating, say, half-a-century back, that the factor on the Douglas estate, writing Lord Douglas to be moved to exterminate the Heronry, then propounded the riddle—"Why are Herons like traitors?" Answer: "Because they hatch high trees-on" *(sic)*"[1] Gilkerscleuch is at an altitude of 878 feet above sea-level, and this, along with the localities next to be named, is the highest lying nesting-place of the Heron in our area. Douglas is at an altitude of about 650 feet. In the parish of Crawford, on the Clyde, near Elvanfoot, there was a large Heronry up to within the last twenty years;[2] but this season there are only two nests in Newton Wood (altitude, about 890 feet), and two are also known in Yewsgill Wood, on the farm of Castle Crawford (altitude, about 850 feet), and a further two in Glespin Wood, on the farm of Midlock Crawford (altitude, about 880 feet). These nests are in Scots Firs 20 to 30 feet high.[3] The only other Heronry I know of on the Clyde was at Hamilton, where up to about fifteen or twenty years ago nests were very numerous, both in the Heron Hill and Barmichael Woods (near Bothwell Bridge). They are believed to have been introduced by Alexander, the 10th Duke of Hamilton (1767-1852), who had them fed for many years in the Basket Hill Wood until they got attached to the place.[4] His Grace seems himself to have been attached to these birds, for between 1800 and 1810, when he lived at Ashton Hall, Lancashire, he "brought some Herons from Hamilton Palace and had them in the paddocks."[5] At Hamilton in 1835 there were about 30 nests in the loftiest trees, and it is remarked that the "birds are frequently attacked by the carrion crow, on their return from their fishing expeditions, and the prey snatched from them;"[6] in 1856 the nests were "very numerous;"[7] and in 1876 the locality is one of the two named in the *Fauna and Flora of Clydesdale, &c.*, p. 10. At Forrestfield there used to be a Heronry, but it is about

[1] Rev. J. D. W. Gibson, *in lit.* to Mr. John Paterson, 22nd April, 1899.
[2] *Fide* Mr. A. Fingland, Eglinton.
[3] Mr. J. Cranstoun, *in lit.*, 30th May, 1899.
[4] Mr. G. M'Dougall, *in lit.* to Mr. G. Cleland, 14th Nov., 1898.
[5] F. S. Mitchell: *Birds of Lancashire*, 2nd ed. (1892), p. 143.
[6] *N.S.A.*, VI. (1835), p. 261.
[7] *Fide* Mr. G. M'Dougall.

forty years since the last nest was seen, and the number of nests cannot be given. They were on Larch trees, and the birds are supposed to have been driven away by the lessening of the trees and the laying of a railway close by the plantation.[1] Out of my Lanarkshire localities, then, there are only Crawford and Douglas Castle in existence to-day.

Stirlingshire.

In the part of this county which is in "Clyde" the old *Statistical Account*[2] gives the following record (which, it may be mentioned, is the only notice in that work of the nesting of the Heron in "Clyde"), under Killearn:—"Herons have their periodical haunts in several places of the parish, as at Balglass and Corbeth, where in tall Fir trees they annually bring forth their young." Another Stirlingshire Heronry of which I can tell was also in this parish, and I regret to say is now extinct; but, thanks to Mr. J. A. Harvie-Brown, the complete story is available by means of the correspondence which he generously placed at my disposal, and which is summarised below. I had often heard of a Heronry—a large one—at Killearn House, but on two recent visits (1897 and 1898) could see nothing of it. Subsequently I learned that about six years ago (1893) the birds deserted the place altogether for breeding, the immediate cause being a gale which blew down some of their nesting trees. Emeritus Prof. Blackburn, who remembers the place fifty years ago, says there were no Herons nesting then, and they probably first built about 1859.[3] The charming sketch in Mrs. Blackburn's *Birds from Moidart and Elsewhere* of a "Heron's nest and young was drawn from one which had fallen from a high tree at Killearn,"[4] and the print is dated 1862. There were only three or four nests then, but they slowly increased, and about 1876 there were eight nests in the Heron Badan, and three or four at the foot of the glen, and one year three at the junction of the Dhualt and the Blane. This was the maximum, and the hard winters of 1879-80 and 1880-1 killed a great many birds,

[1] Mr. G. Young, *in lit.*, 17th January, 1899.
[2] Vol. XII. (1795), p. 109.
[3] Mrs. Blackburn, *in lit.*, 8th February, 1899.
[4] Edinburgh, 1895, p. 133.

and they gradually diminished [1] until the climax came as above stated. It is possible some of these birds may have resorted to the policies of Buchanan Castle, as I am informed that there are single nests in that locality. I am also told by Mr. Walter Brown that a small colony of six or eight nests exists at the Mid Lodge, near the River Endrick, in Larch trees. This seems to have been known as far back as present recollections go. At Craigallian, Herons have been known within recent years to nest in the wood on the north-east side of the beautiful little loch there, but only to the number of one or two pairs. None was observed this year.

Dumbartonshire.

Mr. James Lumsden says that "none breed in the Loch Lomond district, so far as I know," but that 20 or 30 years ago they nested on Inch Connachan, but only to the extent of three nests.[2] In June, 1899, I was in Luss Straits on three separate occasions, and always saw a few Herons about. When disturbed they moved into either Inch Tavannach or Inch Connachan, and I saw one alight on a tree on the last-named island. Both islands are densely wooded, and it is not improbable that there are again one or two Herons' nests therein. Gray writes "there is a small Heronry on one of the islands," [3] and Mr. Harting (under Stirlingshire) that a "few pairs nest on an island at the head of the loch." [4] This is, no doubt, Elan-a-Vow, but they are not there now, and it seems rather remarkable that such a favourable locality as Loch Lomond is Heronry-less. In Mr. Harvie-Brown's interleaved copy of Gray's *Birds of the West of Scotland* (1871), there is a Heronry entered at "Glen Fruin, *auct.* R. Gray:" and also, "Kirkintilloch, at Gartshore, a Heronry, within ten years back;" and the new *Statistical Account* takes the last-named back to an earlier date, when it says, under "Bertram Shotts"—"the *Ardea cinerea* often visits us from Hamilton, Gartshore, and other places." [5] Mr. W. A. Donnelly informs me that

[1] Miss Mary Blackburn, *in. lit.*, 7th February, 1899.
[2] *Guide to the Nat. Hist. of Loch Lomond* (1895), p. 47.
[3] *Quadrupeds, Birds, and Fishes of Loch Lomond, &c.*, (1864).
[4] *Zoologist* (1872), p. 3269. [5] Vol. VI., p. 627 (1839).

near Auchentorlie House (almost opposite Erskine) Herons have from time to time made an attempt to build, the last instance of which was in the spring of 1876, when a pair commenced a nest in the rookery at the Temple, but abandoned it. At Rosneath there is a Heronry which is supposed to be of old date, and which is still vigorous. The Duke of Argyll, who was born at Ardincaple Castle, opposite Rosneath, in 1823, seems to recollect this Heronry from his early days.[1] The birds used to build on the side of the wood facing Green Isle Point, but many of the trees have been destroyed by gales,[2] and they now nest deeper in the wood, and spread all through it as far as to Meiklecross Bay. The wood is mostly of Spruce Firs, but there are a considerable number of good Scots Firs, and in the latter the birds nest high up, say 60 to 70 feet. On a recent visit (8th April, 1899) I counted 35 nests, usually only one in a tree, but one tree had four. In such trees those nests have to be looked for, and are not easily seen, and I may have overlooked a few, but I hope this colony is not reduced since 1894 from the 70 nests then "estimated,"[3] although the probability is that here, as in most other places, the numbers are decreasing, but, notwithstanding, it is the largest Heronry in "Clyde" at present. The young seem to be usually hatched out in the month of March here.

Buteshire.

This island county has, at any rate, two extant Heronries, one of which, at Mount Stuart, has been known for more than one hundred years. John Blain, who came to Rothesay in 1761 as Town Clerk (died 1820), wrote a *History of the Island of Bute*, in which he says, "Herons breed in considerable number among the planting at Mount Stuart,"[4] and at the present time

[1] "A Chat about Herons," *Badminton Magazine*, September, 1898, p. 241.

[2] W. C. Maughan: *Rosneath, Past and Present* (1893), p. 244.

[3] *Trans. Nat. Hist. Soc. Glas.*, IV. (N.S.), p. 272. Mr. Maughan, in his *Annals of Carelochside* (1896), p. 170, says that "there were last year over 80 nests;" but in reply to my inquiry he informs me that this may possibly be a mistake (*in lit.* 1st November, 1899). Mr. Maughan also kindly reports having heard that a few Herons nest on Duchlage, Rosneath, but I have not yet been able to confirm this.

[4] Bryce's *Geology of Arran, &c.* (4th ed., 1872), footnote, p. 296, and p. 304.

there are two colonies within the policies. Near the mansion-house, high up in Beech trees, all in one place, are a few nests [1] (say about half-a-dozen), and in the other place are about twelve nests in Scots Firs. The last-named place has been known for at least twelve years, and four years ago (1894) there were only about six nests, [2] which, I hope, means a genuine increase. At the north end of the Island of Bute Mr. Robert H. Read, on 4th April, 1893, found a breeding-place which must have existed for some years, with about a dozen nests, but many of them were evidently deserted. "The nests," as Mr. Read writes to me, [3] "were mostly built on the tops of thick hawthorn bushes, but there was one (or more) in an oak. Although not more than 10 or 12 feet from the ground, these nests were most difficult to get at. They were fully a yard in diameter. . . . I found one with three eggs and another with four." Mr. Read seems only to have been in time to see the last of this colony, for when he visited the place again, in April, 1897, it was entirely deserted, and he did not see a bird in the neighbourhood. [4] In 1884 Mr. David M. Scott, of Lamlash Lighthouse, stated that Herons were always in the locality, "as they breed on the high rocks on the island" [5] (Holy Island); but the present principal keeper, Mr. James Edgar, does not think they nest there. In the summer he has seen as many as 20 at a time frequenting the high rocks on the south-west side of the island, and it is believed that the Herons from Brodick Castle bring their young, as soon as they can fly, over to Holy Island, as a feeding ground. [6] Regarding the Brodick Heronry, about 1872 there was a considerable number of nests, [7] and they were placed in high Beech trees near the Castle. There is a local superstition that the prosperity of the Dukes of Hamilton is connected with

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[1] Marquess of Bute, *in lit.*, 25th February, 1899.

[2] Mr. F. W. Saunders, *in lit.*, 3rd March, 1899.

[3] 31st December, 1898. See also R. Bowdler Sharpe's *Handbook to the Birds of Great Britain*, III., pp. 72-3 (1896).

[4] *Proc. Nat. Hist. Soc. Glas.*, V. (N.S.), 1897, p. 148.

[5] *Report on Migration of Birds for 1884*, p. 78.

[6] Mr. J. Edgar, *in lit.*, 10th April, 1899.

[7] Bryce's *Geology of Arran, &c.* (4th ed., 1872), p. 304.

the continued existence of this Heronry, and the saying is current that "when the Herons are gone, the Dukes o' Hamilton will be gone too." [1] In Arran the latter event has recently come to pass, if the saying is to be taken in a literal sense, but as regards the Herons, Mr. Patrick Murray, Chamberlain of Arran, informs me (*in lit.*, 6th May, 1899) that there are twelve nests occupied at present, in Beech trees, and that he does not think the Heronry is decreasing in size, and that it is older than the oldest inhabitant. The birds were protected by order of the late Duke of Hamilton, and this policy is being kept in force.

Argyllshire.

Of the extensive portion of this county in "Clyde," with its deeply indented and lengthy coast-line, it is not easy to render a complete account, but I have the following information. On Loch Long, at Ardgartan, in the Boathouse Wood, in Larch trees, Herons have nested since 1870 at least, and are believed to have increased in numbers, as they are not allowed to be interfered with.[2] At one time there might be about a dozen nests, and it is also reported that there was a nesting place on the neighbouring property of Coilessan. On 29th April, 1899, I visited Ardgartan and the Boathouse Plantation, which is a small patch of detached wood, mostly Larch trees and some Scots Firs, above the shore of the loch. The trees are not large, and I only found one nest, in a Scots Fir, from which I saw the bird fly, but the grieve (M'Dougall) pointed out to me stumps of other Firs, in which he remembers Herons nesting, before the trees were

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[1] Geo. Milner: *Studies of Nature on the Coast of Arran* (1894), p 185. It may be worth noting that similar traditions attach to other Scottish Heronries and noble families. Thomas the Rhymer is said to have prophesied that—

> "When the heron leaves the tree,
> The lairds of Gight shall landless be;"

and Lord Teignmouth, in his *Reminiscences*, says, "I found the ancient Castle of Darnaway, in Moray, tottering in the estimate of superstitious neighbours, who prognosticated ill as a consequence of the seeming departure of the herons."

[2] Mr Donald MacGregor, *in lit.*, 22nd March, 1899.

blown down, some years back. The birds frequent the neighbouring hillside, which along the loch side towards Coilessan has a belt of young Oaks, Alders, and Birches, and on the previous night they had been making a great noise. It is thus probable that there are a few more nests about, and during the three days I was at Arrochar, I never missed seeing a Heron or Herons about the loch. The Holy Loch is a favourite resort of the Heron, but the only place there that I know of it nesting at present, and that by report, is on the Hafton estate.[1] Previous to 1845 "there was a regular Heronry in a clump of Scotch Firs not far from Hafton House, but they [the Herons] have latterly again abandoned it,"[2] so the present colony, whatever it may be, is apparently a case of re-occupation. The Heron was said to "frequently nestle" in the parish of Dunoon and Kilmun,[2] but the only further definite report I have is of one nest near Massan Bridge, in 1890, on a Larch tree, 70 feet from the ground.[1] In spite of statements to the contrary, it does not nest on the estate of Benmore.[1] At Ballimore, Otter Ferry, is a Heronry, which I first heard of through Mr. John Renwick, and where, I am informed, there were 16 to 18 nests this spring. They are situated in Larch trees, in a wood near the shore of Loch Fyne.[3] At Inveraray there is a Heronry or Heronries, probably of old date, and in full vigour to-day. In a Larch wood on Loch Shira there used to be a number of nests, but some years ago a storm destroyed part of the wood, and in 1897 there were only one or two nests in this locality. A number of the birds found a fresh nesting-place nearer the town of Inveraray, where they had in 1897 nests to the number of about 16, in Scots Firs, Larch, and Beech trees.[4] This year the following statement appeared in the *Glasgow Evening Citizen* (1st April, 1899)—"A great increase has taken place in the colony of Herons that established themselves about three years ago on the trees on Craigdhu,[5] overlooking Inveraray from the north-west. The nests now number several score." I felt

[1] Mr. C. S. Roedsmer, *in lit.*, 18th March, 1899.
[2] *N.S.A.*, VII. (1845), p. 589.
[3] Major J. MacRae-Gilstrap, *in lit.*, 9th August, 1899.
[4] Rev. Wm. Stirling, *in. lit.*, 28th December, 1897.
[5] Creag Dhubh in O.S. map. It is the same locality mentioned by W. S.

convinced that there was a mistake here as to the numbers, and this opinion is confirmed by a letter from Mr. Jas. Cameron, dated 28th April, 1899, in which he says that this year he can count 21 nests, but he does not think more than 14 or 15 of them are occupied.[1] Most of the nests are in Beech trees, which predominate. The birds used to build further away from the town in the same wood (Craigdhu), but a few years ago a great many trees were blown over with their nests, and they shifted to the present place facing the pier. The Larch plantation at Loch Shira was thinned two years ago, and the Herons entirely left it. Mr. Cameron does not think there is any appreciable increase in their numbers for the last few years. Mr. Gideon Scott (*in. lit.* to Mr. A. Ross, 6th May, 1899) remembers about twelve years ago a Heronry in a small clump of Scots Firs, which grow at the end of a Spruce plantation, opposite the Salmon Fishery at Inveraray, but no Herons build there now; and he is also informed that twenty-five years ago there was a Heronry in Spruce Firs near Collievraat Loch, in the Deer Forest. The birds all left at one time, and on the trees being cut down a short time afterwards, every one was found to be "dosened" or "corkit," *i.e.*, decayed at the heart. On 8th and 9th June, 1899, I saw several of the Craigdhu Herons, and observed that they were feeding their nestlings. Mr. John Paterson saw two young ones in one nest. Kilmory (Lochgilphead) possessed a well-known Heronry, long frequented, and remarkable as being situated in trees within a hundred yards of the mansion-house,[2] but a few years ago a good portion of the timber was cut down, and the birds, being thus disturbed, seem not to have nested there since.[3] It is difficult to believe that they have entirely quitted this very suitable district, but the only other Heronry there which I have a note of, is in "Argyll" area, at the landward end of Loch Swen.[4] Near the head of Glen Saddell is a small

[1] 19 nests with young and 8 old nests, according to Mr. G. Scott, *in lit.*, 6th May, 1899, to Mr. A. Ross.

[2] C. A. Johns: *British Birds* (1888), p. 408; and H. D. Graham *Birds of Iona and Mull*, p. 230.

[3] Mr F. Grey, *in. lit.* to Mr D. Dewar, 27th October, 1897.

[4] *Zoologist* (1882), p. 284.

Heronry of five or six nests in Fir trees. Some years ago there was only one pair that nested regularly, but protection being extended to the birds, they have increased. That they are quite at home will be understood when I say that Colonel McLeod informs me that one severe winter they came to his house and fed with gulls and other birds close to the door.[1] They have been known to nest here forty years ago, and may have been more numerous then.[2] My last record is from the furthest west point in our area—the Mull of Kintyre. Here is a great stretch of barren, treeless land, heather and rock, said to extend for 50 or 60 square miles, and the Heron, adapting itself to its surroundings, nests on ledges of rocks or large stones or on the ground.[3] To what number I cannot say, and it might be difficult to find out, but that there is a large number of Herons sometimes in Kintyre is borne out by the following observation :—"I remember on two occasions in the autumn of 1896 of seeing from 100 to 150 of the birds all standing close together on a hill-side above a fresh-water loch (Auchylochy), all the time keeping up an incessant harsh gabble, which could easily have been heard a mile away."[4]

SUMMARY.

The tabular list which follows contains the names of 55 nesting localities altogether, some twenty of which are occupied at present, but of these six or seven are in a precarious condition. I would estimate that there may be in our area this season a total of about 215 nests of the Heron. Assuming that from these nurseries 350 young are reared successfully and sent out on the journey of life, these, along with the parent birds, = 430 (2 for each nest), and young which may be produced from possible second broods and unmated birds, which together I assume to amount to a further 120, will form a Heron population of about 900 individuals in the autumn. I think this census is approximately

[1] Colonel J. N. McLeod, *in lit.*, 7th March, 1899.
[2] *Fide* Mr. A. Gray.
[3] Mr. A. Gray, *in lit.*, 27th February, 1899.
[4] *Lit. cit.* (above).

correct, and that migrating birds have little or no influence upon it. The Heron seems to be one of our most sedentary species, as may be seen by the absence or scarcity of reference to it in the "Reports on the Migration of Birds," 1880-87,[1] and the "Reports on Movements and Occurrences of Birds in Scotland, 1892-8;[2] and Gätke speaks of its "extreme rarity" in Heligoland: "only one or two young Herons are met with on some of the days of the general autumn migrations."[3] From these 900 birds, then, our stock has to be maintained; and it may be asked what prospect is there of this being successfully done? I am afraid that the tendency is towards a decrease in numbers, due, generally speaking, to what is called, by a euphonious phrase, the spread of civilisation. Civilisation is represented amongst us by the pollution and corruption of our water-ways and atmosphere, by the increase and spread of man and his works, by reclamation of marshlands, by more deadly certainty in the weapon in the hand of the prowling gunner, and by pride in the destruction of specimens of this once "royal" bird. To these causes may be added the conspicuous size and striking appearance of the bird, and the destruction of the trees in which it nests by (1) natural decay, (2) severe weather, (3) felling, and (4) the ill effects which the nests themselves must have on the trees in which they are placed. On the other hand, and as favouring the increase of the species, we have the extension of tree-planting, and the protection of the species (along with others) by statutes, and, most effectually of all, by individuals—such as proprietors and lessees of properties on which it nests. This may be said to be universal now (such a project as that of the old factor of Douglas being impossible), but, as illustrated by what is contained in the body of this paper, seems only to be effective when circumstances—such as remoteness from centres of human population and seclusion, such as the Highlands afford—come to the aid of the protectors.

The sites I have named for the nests—Scots Firs, Spruce, Larch, Beech, Ash, Oak, and Hawthorn trees (the first-named greatly in the majority), varying in height above the ground from 10 to 70

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[1] Committee of the British Association.

[2] *Annals of Scot. Nat. Hist.*

[3] *Heligoland as an Ornithological Observatory* (1895), p. 455.

feet; on islands, on rocks, and on the ground; always in the vicinity of water, fresh or salt—are typical of the species; but the number of solitary nests (seven) I have noted seems to be exceptional. Mr. H. E. Dresser, in his *Birds of Europe*, seems to have found it necessary to go to Germany to find an example, of solitary nesting, which he considers occurs "rarely." [1]

ALPHABETICAL LIST OF NESTING PLACES OF THE HERON (*Ardea cinerea*, Linn.) IN THE CLYDE FAUNAL AREA.

Locality.	County.	Nests.			Known Period.
		Situation.	Maximum Number about	Present Number about	
Ardgartan,	Argyll.	Larch Trees.	12	6 ?	*
Ardgowan,	Renfrew.	Scots Firs and Larch.	...	10	*
Balglass,	Stirling.	Firs.	...	None.	1795.
Ballimore, Otter Ferry,	Argyll.	Larch.	...	18	*
Brodick Castle,	Bute.	Beech.	...	12	*
Buchanan Castle,	Stirling.	Larch.	...	8	*
Bute, North,	Bute.	Hawthorn Bushes and Oak.	12	None.	Up to 1893.
Caldwell,	Ayr and Renfrew.	...	...	None.	1865 ?
Caprington,	Ayr.	Fir.	1	None.	Old.
Castle Semple,	Renfrew.	Spruce Firs, etc.	14	1	*
Coilessan,	Argyll.	*See* Ardgartan.	...	...	...
Corbeth,	Stirling.	Firs.	...	None.	1795.
Craigallian,	Stirling.	Trees.	Few.	None.	Recent.
Craigengillan,	Ayr.	Larch.	Good many	None.	Up to 1884-5.
Craigie,	Ayr.	...	...	None.	Before 1872.
Crawford,	Lanark.	Scots Firs.	Large.	6	*
Doonside,	Ayr.	Ash.	1	None.	1889-97.
Douglas Castle,	Lanark.	Spruce.	12	12 ?	*Since 1870.
Duchlage,	Dumbarton.	*See* footnote, page 390, *ante*.	...	...	* (?)
Dunoon,	Argyll,	*See* Kilmun.	...	...	...
Eglinton Castle,	Ayr.	Beech and Scots Firs.	30	30	*Since 1833.
Erskine,	Renfrew.	Trees.	Large.	2	*
Forrestfield,	Lanark.	Larch.	...	None.	Up to 1859.
Fullarton,	Ayr.	Scots Firs.	Numbers.	2	*
Gartshore,	Dumbarton.	...	...	None.	Up to 1860 ?
Gilkerscleuch,	Lanark.	Trees.	Extensive.	None.	Last Century.

* In existence at present, and back to a date which has not been ascertained.

[1] Vol. VI., p. 214.

ALPHABETICAL LIST OF NESTING PLACES—*Continued.*

Locality.	County.	Nests.			Known Period.
		Situation.	Maximum Number about	Present Number about	
Girvan Water,	Ayr.	Bank of river.	1	None.	Recent.
Glenapp,	Ayr.	...	Seldom.	None.	Recent.
Glenfruin,	Dumbarton.	...	...	None.	Before 1871?
Glespin Wood,	Lanark.	Spruce.	...	None.	Up to 1872.
Hafton,	Argyll.	Scots Firs.	Regular.	...	Up to 1840 and * (?)
Hamilton,	Lanark.	Trees.	Very numerous.	None.	1800 to 1880.
Holy Island,	Bute.	Rocks.	...	None.	1884.
Houston House,	Renfrew.	...	...	1	1898.
Inchinnan,	Renfrew.	Firs.	...	None.	Up to 1845.
Inveraray,	Argyll.	Spruce, Scots Firs, Larch, and Beech	...	20	*
Inverkip,	Renfrew.	*See* Ardgowan.	...	...	...
Johnstone Castle,	Renfrew.	...	2	2	1897-8.
Kelburn Park,	Ayr.	Beech.	Large.	25	*
Kennox,	Ayr.	...	...	None.	1893?
Kilkerran,	Ayr.	...	1	None.	1897?
Killearn,	Stirling.	Trees.	12	None.	1859 to 1893.
Kilmory,	Argyll.	Trees.	...	None.	Recent.
Kilmun,	Argyll.	...	Frequent.	None.	Up to 1845.
Kintyre, Mull of,	Argyll.	Rocks and ground.	...	...	*
Lanfine,	Ayr.	Spruce.	1	None.	1879.
Loch Fergus,	Ayr.	Trees on island.	Plenty.	None.	1597 to 1820?
Loch Goosey (not in "Clyde"),	Ayr.	Trees on island.	...	2?	* (?)
Loch Lomond, Elan-a-Vow,	Dumbarton.	...	Few.	None.	Up to 1872.
Inch Connachan,	Stirling.	Trees on island.	3 or 4.	None?	Up to 1870 and * (?)
Massan Bridge,	Argyll.	Larch.	1	None.	1890.
Monkcastle,	Ayr.	...	...	None.	Up to 1832.
Mount Stuart,	Bute.	Scots Firs and Beech.	...	18	*
Rosneath,	Dumbarton.	Scots Firs.	80?	35	*
Saddell, Glen,	Argyll.	Firs.	6?	6	*

* In existence at present, and back to a date which has not been ascertained.

Measurements of Notable Trees at Eglinton Castle.

By John Renwick.

[Read 1st August, 1899.]

(A few measurements of later date are included.)

	Date.	Girth. Ft.	In.	At Ft.	In.	Bole. Feet.
1. Alder (*Alnus glutinosa*, Gærtn.),	Sept., 1896,	10	7½	3	3	4
2. Crab Apple (*Pyrus Malus*, Linn.),	May, 1895,	7	8½	3	8 [1]	
3. Ash (*Fraxinus excelsior*, Linn.), at Corshill Gates,	Sept., 1892,	6	9¾	3	0	
4. Do., with simple leaves,	Oct., 1899,	4	6	5	0	30
5. Beech (*Fagus sylvatica*, Linn.), in Old Wood	June, 1892,	17	7½		[2]	
	Sept., 1895,	17	10½	4	9	8
	May, 1899,	18	3½			
	Sept., 1889,	16	9½	4	6	
6. Do., Bullock Park,	Sept., 1894,	17	3	5	0 [3]	
	May, 1899,	17	7	5	0	
	Sept., 1896,	15	9½			
7. Do., Deer Park,	May, 1899,	16	0½	5	0	12
8. Do., in Old Wood,	June, 1897,	15	10¾	3	0 [4]	8
9. Do., Deer Park,	July, 1899,	15	2¾	5	0	
10. Do., do.,	May, 1899,	15	2	3	2 [5]	6
11. Do., in Old Wood,	July, 1895,	15	0	2	10 [6]	6
	Oct., 1899,	15	4½			
12. Do., Deer Park,	May, 1899,	14	8	4	7 [7]	5
	June, 1892,	13	10½			
13. Do., in Old Wood,	Sept., 1896,	14	2	4	5	11
	May, 1899,	14	4			
14. Do., Bullock Park,	Sept., 1896,	14	2½	4	6 [8]	
15. Do., do.,	Sept., 1896,	14	1½	5	0	
	June, 1892,	13	7			
16. Do., in Old Wood,	Sept., 1895,	13	10	4	6	12
	May, 1899,	14	1½			
17. Do., Bullock Park,	Sept., 1896,	12	6	5	0	25
18. Do., near flushes,	Sept., 1889,	9	2½	4	3	35
	March, 1899,	9	8½			

[1] Decaying in 1895. Blown down since then.
[2] Girth at ground, 33 ft. 6 ins. Divides into seven stems.
[3] *Fide* Mr. George Paxton.
[4] Swells out above 3 ft. Divides at 8 ft. into two large stems.
[5] Diameter of spread of branches, 101 ft. 3 ins.
[6] Divides at 6 ft. into five stems. Trunk fluted.
[7] Diameter of spread, 113 ft. 5 ins.
[8] Large branch goes off at 5 ft., and measures in girth 6 ft. 3½ ins. at 3 ft. from stem.

	Date.	Girth. Ft.	Girth. In.	At Ft.	At In.	Bole. Feet.
19. Beech (*Fagus sylvatica*, Linn), near flushes, .	Sept., 1889,	7	10¼	4	3	
	Sept., 1896,	8	2¾			
	March, 1899,	8	4¼			
20. Do., with cut leaves, opposite gardens, . .	Sept., 1896,	8	8½	2	9	4
	July, 1899,	8	11½			
21. Cedar of Lebanon (*Cedrus Libani*, Barrel.), . .	June, 1892,	9	10	2	0 [1]	
	May, 1899,	9	11	2	4	5
22. Horse Chestnut (*Æsculus Hippocastanum*, Linn.), in front of Castle, .	About 1882,	17	3	3	0 [2]	5
23. Do., Deer Park, . .	May, 1899,	11	4	4	0 [3]	7½
24. Do., do., .	May, 1899,	10	4	5	0	16
25. Spanish Chestnut (*Castanea sativa*, Mill.), Bullock Park, ...	About 1877,	13	9	5	0 [4]	
	Sept., 1889,	15	2	4	8	
	May, 1899,	15	11½	4	8 [5]	12
26. English Elm (*Ulmus campestris*, Sm.), at Castle, .	About 1881,	12	3	5	0 [6]	23
	Sept., 1894,	12	7	5	0 [7]	
	May, 1899,	12	7½	5	0 [8]	
27. Wych Elm (*Ulmus montana*, Sm.), . . .	Sept., 1894,	11	2	5	0 [9]	
28. Do., Deer Park, .	Oct., 1899,	9	6½	5	0	20
29. Silver Fir (*Abies pectinata*, DC.), ...	June, 1892,	11	1	5	0	
	Sept., 1896,	11	3¾			
	July, 1898,	11	4½			
30. Gean (*Prunus Avium*, Linn.), on river bank, .	June, 1892,	11	3	10	0 [10]	
31. Do., Bullock Park, . .	May, 1899,	11	0½	3	3	7
32. Do., Deer Park, . .	July, 1899,	6	1½	4	4	7
33. Do., in Old Wood, . .	June, 1892,	5	6½	4	6	17
	Sept., 1895,	5	8½			
	Oct., 1898,	5	10½			
34. Hornbeam (*Carpinus Betulus*, Linn.), . . .	June, 1892,	15	2½	1	0	1½
	July, 1898,	15	5			
	Sept, 1895,	13	8	1 to 1½ feet. [11]		
	July, 1898,	13	9			
	June, 1897,	5	7¾	5	0 [12]	18
		5	4½	5	0	20
		4	11¼	5	0	13

[1] *Fide* Mr. John Smith.

[2] Height, 56 ft. Diameter of spread, 70 ft. (Mr. R. Hutchison, in *Highland and Agricultural Society's Transactions*, 1884). Blown down.

[3] Diameter of spread, 75 ft. 8 ins.

[4] Height, 55 ft. (Mr. R. Hutchison, in *Highland and Agricultural Society's Transactions*, 1879).

[5] Decaying.

[6] Height, 72 ft. (Mr. Hutchison, *Highland and Agricultural Society's Transactions*, 1883).

[7] *Fide* Mr. Paxton. [8] Decaying. [9] *Fide* Mr. Paxton.

[10] Tree fallen. *Fide* Mr. John Smith.

[11] At narrowest part on an irregular line. Divides at 1½ ft. into three stems.

[12] Boles of the three stems, and girths at 5 ft. from the ground.

	Date.	Girth.	At	Bole.
		Ft. In.	Ft. In.	Feet.
35. Larch (*Larix europæa*, DC.),	Sept., 1896,	8 $9\frac{3}{4}$	5 0	50
36. Common Maple (*Acer campestre*, Linn.),	Sept., 1896,	6 $5\frac{3}{4}$	5 0	
37. Great Maple (*Acer Pseudo-Platanus*, Linn.), Deer Park,	Sept., 1896,	13 $2\frac{1}{2}$	5 0	10
38. Do., do.,	Oct., 1899,	11 $10\frac{3}{4}$	5 0	15
39. Do., near Corshill Gates,	Sept., 1889, March, 1899,	8 7 8 $10\frac{1}{4}$	4 8 — [1]	10
40. Do., do.,	Sept., 1889, March, 1899	4 11 5 $1\frac{3}{4}$	4 3 — [2]	31
41. Oak (*Quercus Robur*, Linn), Deer Park,	Oct., 1899,	10 $11\frac{1}{2}$	5 0	13
42. Do., do.,	Oct., 1899,	10 $1\frac{1}{2}$	5 0	18
43. Do., near "Angles,"	Oct., 1899,	6 4	5 0	30
44. Evergreen Oak (*Quercus Ilex*, Linn.),	May, 1899,	5 $2\frac{1}{2}$	1 10	
45. Scotch Fir (*Pinus sylvestris*, Linn.),	June, 1892, Sept., 1896,	10 11 11 0	3 7	17
46. Black Poplar (*Populus nigra*, Linn.),	March, 1899,	8 $4\frac{1}{2}$	5 0 [3]	50

[1] Height, 57 ft. [2] Height, 50 ft. [3] A large branch goes off at 8 ft.

Species.	Years.	Increase in Girth.	
		Inches.	Yearly Average.
5. Beech,	7	8	1·14 inch.
6. Do.,	4 fully.	4	1 "
7. Do.,	Say, $2\frac{1}{2}$	3	1·20 "
11. Do.,	Say, $4\frac{1}{2}$	$1\frac{3}{4}$	·88 "
13. Do.,	7	$5\frac{1}{2}$	·79 "
16. Do.,	7	$6\frac{1}{2}$	·93 "
18. Do.,	9	$6\frac{1}{4}$	·69 "
19. Do.,	9	6	·65 "
20. Do., cut-leaved,	Say, $2\frac{3}{4}$	3	1·10 "
39. Great Maple,	9	$3\frac{1}{4}$	·35 "
40. Do.,	9	$2\frac{3}{4}$	·30 "

The first two Beeches noted in the foregoing table are among the largest in Ayrshire. The one near the Castle (No. 6), although less in girth than the other, is a finer tree, being taller and having a

longer bole. The only Beech in the county that approaches them, so far as I know, is one near Stair House, on the bank of the river Ayr, which, in October, 1892, had a girth of trunk of 17 feet 8 inches at 4 feet 3 inches.

The Horse Chestnut recorded by Mr. R. Hutchison in the *Highland and Agricultural Society's Transactions* for 1884, is described by him as a very noble tree, and outstripping all other specimens in the district. He says—"It girths 17 feet 9 inches at 5 feet, where its bole divides into a beautifully umbrageous head. This is indeed a very old tree, and shows evident symptoms of antiquity. It stands near the front court of the Castle, and has been clasped very many decades gone by, and bolted on several occasions, the bolt in some cases passing right through the main trunk. Its girth is 17 feet 3 inches at 3 feet, and at 4 feet it branches out into heavy limbs, two of which measure 12 feet 6 inches at the joint with the trunk, and are 9 feet 6 inches and 9 feet 10 inches after they divide. The diameter of spread of branches is 70 feet clear." This description refers to a year or two previous to 1884, about which date, or soon after, this venerable tree was wrecked in a severe storm. The two trees growing in the Deer Park are both handsome. There is a larger one at Loudoun Castle, with a girth of trunk in April, 1899, of 14 feet at 2 feet, and dividing at 4 feet into two large stems. Mr. George Paxton records one at Cloncaird Castle with a girth of 13 feet 10 inches at 5 feet in June, 1894.

The Hornbeam in the table is a peculiar tree. It looks like one tree dividing into three stems at about 18 inches from the ground, but it may really be three trees joined together at the base. The measurements at 1 foot up, and even those at the narrowest part, about 18 inches to 2 feet up, are not quite satisfactory. The former are not free from the swollen base, while the latter are in part above the point where the tree divides. Still they show a fairly uniform rate of increase, and a later measurement, in October, 1899, gives an increase of one inch upon the previous figures for July, 1898, noted in the table.

White Cattle: An Inquiry into their Origin and History.

By R. Hedger Wallace.

[Read 27th December, 1898.]

Part Ib.

I now pass on to note what might be considered the historical data on which some of the statements already made have been based (pp. 220-273). The endeavour has been made to place them in some order, but it is not claimed that the arrangement is chronological.

We obtain some information from comparing the Authorised and Revised Versions of the Bible,[1] and the explanatory aids to the same by our modern divines. The first thing noticeable in comparing the two is that the wild bull and unicorn of the one have become the antelope and wild ox of the other. For example:—

Authorised Version of 1611.	*Revised Version of 1885.*
(*a*) The hart, and the roebuck, and the fallow-deer, and the wild goat, and the pygarg,[2] and the wild ox, and the chamois."—*Deut.* xiv. 5.	(*a*) ". . . the hart, and the gazelle, and the roebuck, and the wild goat, and the pygarg, and the antelope, and the chamois."—*Deut.* xiv. 5.
(*b*) "as a wild bull in a net."—*Isa.* li. 20.	(*b*) "as an antelope in a net."—*Isa.* li. 20.

Canon Tristram, writing on this point, says: "Wild Bull"—the word so rendered is neither the bison nor the buffalo, but some species of large antelope, formerly much more common than now. It is probably *Alcephalus bubalis*, the bubale or "wild cow" of the Arabs. A writer in the *Edinburgh Review* (1886) also points this out, and further states that the white antelope (*Oryx leucoryx*), still found on the confines of Palestine, was hunted by the ancient Egyptians, who also kept large numbers of them in the preserves of their villas. It was known to them as the "white antelope."

[1] According to the Bible the Jews were enjoined to sacrifice "a red heifer without spot."—*Numbers* xix. 2.

[2] Or bison (Heb. *Dishon*).

Here we have an early instance of a white animal preserved in a park. The question may also be raised, were the "bubali" we read of in our early chronicles not antelopes?[1] Whitaker, for example, states that an entry in the records shows when the "bubali or wild cattle" were removed from Blakely to Gisburne Park. On what grounds is "bubali" accepted as standing for "wild cattle?" In translations from the classics it is generally taken to mean buffaloes.[2] Turning again to the two versions of the Bible, we find the following:—

Authorised.	*Revised.*
(*a*) "he hath as it were the strength of an unicorn."—*Num.* xxiii. 22.	(*a*) "He hath as it were the strength[3] of the wild-ox.[4]—*Num.* xxiii. 22.
(*b*) "his horns are like the horns of unicorns." — *Deut.* xxxiii. 17.	(*b*) "And his horns are the horns of the wild-ox."—*Deut.* xxxiii. 17.
(*c*) "Will the unicorn be willing to serve thee, or abide by thy crib? Canst thou bind the unicorn with his band in the furrow? or will he harrow the valleys after thee?"—*Job* xxxix. 9-10.	(*c*) "Will the wild-ox be content to serve thee? Or will he abide by thy crib? Canst thou bind the wild-ox with his band in the furrow? Or will he harrow the valleys after thee?"—*Job* xxxix. 9-10.
(*d*) "And the unicorn shall come down with them, and the bullocks with the bulls."—*Isa.* xxxiv. 7.	(*d*) "And the wild-oxen shall come down with them, and the bullocks with the bulls."—*Isa.* xxxiv. 7.

[1] Kitto, *Physical History of Palestine* (p. cccxciii.), writes:—

"The Oryx [Footnote—Abu Harb, *Antelope leucoryx*] and Addax are not natives of Syria, or even of Egypt, at present, although the former at least was certainly found there in ancient times. It was a conspicuous object of the chase. . . It was one of the animals tamed by the Egyptians and kept in great numbers in the preserves of their villas. We are induced to notice it in this place from the fact that this is the most celebrated of all the genus, being that which appears to have given rise to the famous *unicorn* of the ancients, and to which there are so many references in Scripture."

Also [p. cccc., footnote] "The Wild Cow, *beker el wahesh*, feeds on the herbs in the desert of the district of Djof, fifteen days' journey from Damascus."—*Burckhardt.*

[2] Some Latin dictionaries state that Bubalus is "a buff or wild ox, a buffle or bugle.—*Mart.*, 1. 23"; or "a wild ox, a buffalo.—*Plin.*, 8. 15."

[3] Or "horns." [4] Or "ox-antelope" (Heb. *Reêm*).

In the Authorised Version quotations from Isaiah, marginal readings make the Unicorn into the Rhinoceros, which, I suppose, our divines thought was not such an absurdity under the circumstances as the Unicorn. Canon Tristram says the Unicorn is the Aurochs or Bison, and writes:—"The Unicorn (Heb. *Reêm*), *i.e.*, the Auerochs, the extinct wild ox (*Bos primigenius*), is a familiar emblem of untamed strength and ferocity in the earlier books of the Bible, but is only once alluded to after the time of David. It has nothing to do with the fabled one-horned Unicorn of heraldry, our version being here incorrect. It had two horns, as we see from Deut. xxxiii. 17, where its horns symbolise the two tribes of Ephraim and Manasseh. It became extinct also in Assyria about 1000 B.C., as the country became more thickly peopled." As Canon Tristram found the teeth of *Bos primigenius* in Lebanon, we may take it for granted that the *Reêm* was not the Bison, but the Urus.[1] The *Reêm*, or *Rêm* (Assyrian *Rimu*), is the animal which (according to legend) had to be towed behind the Ark, as its horns would not allow it to get in by the door. We are told that the Assyrian monarchs hunted wild oxen of great height and size,

[1] T. M. Harris, in *The Natural History of the Bible*, 1824, says: "The wild bull is found in the Syrian and Arabian Deserts [Footnote—The Urus of Pliny and the ancients]. It is frequently mentioned by the Arabian poets, who are copious in their descriptions of hunting it, and borrow many images from its beauty, strength, swiftness, and loftiness of its horns. They represent it as fierce and untamable; as being white on the back and having large shining eyes.

Some authors have supposed the buffalo, well known in India, Abyssinia, and Egypt, to be intended . . . others (Bochart, Shaw, Lowth, &c.) have thought it the *oryx* of the Greeks, or the Egyptian Antelope, described by Dr. Shaw under the name of *Bekker el wash*. [Footnote—It is also an inhabitant of Syria, Arabia, and Persia. It is the *Antelope Oryx* of Linnæus."]

Then again—John Brown, of Haddington, in his *Dictionary of the Bible*, 1806, says:—"What animal the *reêm*, which we render *unicorn*, is, whether the wild ox, the wild goat or deer, or a creature called the *unicorn*, is not agreed. . . . It is certain the Scripture *reêms* are fierce, strong, and almost untamable animals. I suppose the urus or wild ox, which is found in Arabia, Hungary, and many other places, is of that kind; or the rhinoceros, which is the strongest of all four-footed beasts, and hath one and sometimes two horns growing on its nose about a yard or more in length."

and we suppose they are the wild bulls depicted on Assyrian monuments (Fig. 32, p. 272; notice the projecting horns). The Assyrians also used to capture the calves of these wild cattle, and bring them alive to their royal abodes. The cattle that would be taken out of Assyria by any wave of emigration would, no doubt, have some of the blood and characteristics of this wild race in them, and from this source, perhaps, their blood has entered into some of the domesticated breeds of Europe.

Allusion has been made to the probability of the Scotch Unicorn having been an Antelope. Still we have no proof to support such a statement; but apparently we once had humped cattle in Britain, which might be regarded as equally strange and improbable. Ellon, in his *Origins of English History* (1890), writes:—"According to the authors of the earliest Triads [Welsh bards], the swarms of wild bees in the woods gave its first name to the 'Isle of Honey'; and the first settlers were supposed to marvel at the bears and wolves, the humped cattle of the forest, and the colonies of beavers in the streams." Were these humped forest cattle white or black? In Egypt, and, we think, in Rome and Greece, the Indian or humped ox was used for sacrifice, and was white, but they were not emblematic of any deity.[1] Such cattle were domesticated, we believe, but the wild or feral specimens may have been black. At any rate, a writer in the *Journal of the Asiatic Society of Bengal* for 1840 states that:—"In the districts of Akbarpoor and Dostpoor,

[1] T. A. Wise, in his *History of Paganism in Caledonia*, writes as follows:—"White bulls were held in especial honour among the Celts, who used to sacrifice them to the moon; and so sacred was this animal regarded among them, that to swear by the image of it was accepted as an oath taken before the Gods. An oath of this kind was once (101 B.C.) given by the Cimbri to the Romans and accepted as a pledge that the terms of the treaty made when they capitulated would be religiously respected. Bulls of a decidedly Hindu character are met with on the stones of Scotland. There is one on the large Meigle Cross, which has the characteristic hump on the shoulder."

A reference to Fig. 20, p. 249, will show that in the relief termed "The Apotheosis of Homer," the sacrificial animal there is also humped.

Wise further writes—"Some of the sculptured stones of Pictavia supply us with interesting archæological details, such as priests in their robes, with books, or in processions with sacred oxen, or oxen about to be sacrificed."

in the Province of Oude, large herds of black oxen are, or were, to be found in the wild and uncultivated tracts; a fact to which I can bear testimony from my own personal observation, having in 1821 come in contact with a very large herd of these beasts, of which we were only fortunate enough to kill one, their excessive shyness and wildness preventing us from a near approach at any second opportunity."[1]

Coming to our early authorities, I may note that references bearing on our subject are very scanty. In this connection I have a letter from Prof. Skeat, who says:—"The literature of early England is largely historical and theological; it never has any references to social affairs except in the vaguest manner. Of course, such words as *ox*, *cow*, *bull*, frequently occur, but only casually and generally. The only sort of literature that could help you would be old charters, deeds, and wills, which are mostly in Latin. I have seen many such, but I really cannot recall any that will tell you anything *definite*. Allusions to *colour* are in all cases, and with respect to all things, of the vaguest kind."

In the laws of King Ine, of Wessex, who succeeded in A.D. 688 and abdicated in A.D. 725, we find the two following clauses:—

"40. A 'ceorl's' close ought to be fenced winter and summer. If it be unfenced, and his neighbour's cattle stray in through his own gap, he shall have nothing from the cattle! Let him drive it out and bear the damage."

"42. But if there be a beast which breaks hedges and goes in everywhere, and he who owns it will not or cannot restrain it, let him who finds it in his field take it and slay it."

This shows, I think, that cattle strayed and wandered over the country, and the two following extracts bear out the same fact. In the laws of King Edgar, who succeeded in A.D. 959 and died in 975, there is the following sentence:—"An oxe's bell, and a dog's collar, and a blast horn; either of these three shall be worth a shilling, and each is reckoned an informer." The bell and horn we find still in use on the Continent, especially in Switzerland. Then in the laws of King Ethelred II., who succeeded in A.D. 978 and died in 1016, we read:—"Let no one slay an ox

[1] Bartholomew, writing in 1360, says that "Bulls of Ind be red, and swift and cruel."

except he have the witness of two true men, and that he keep for three nights the hide and the head." This restriction, we assume, was enforced so that owners might be able to find their oxen again.

Turning now to the Gwentian Code, we find it laid down that the worth of wild and tame animals, of which people make use, is to form part of a judge's knowledge. Distinct breeds were also recognised, for we read that "there are three animals whose teithi [qualities] exceed their legal worth—a stallion, a hamlet bull, and a herd boar; for the breed be lost if they be lost." As regards the "hamlet bull," was he in colour white or black? The code tells us that "the worth of a hamlet bull is another bull that can leap, with a cow before him and another behind him." A reference as to colour in the code is found in the following extract:—"If an ox die by over-ploughing, the owner has an erw [a measure of corn given in compensation], and that is called the erw of the black ox." Here we find "black" being used in the sense of a general colour, say, of the herd, which then was legally twenty-four cows and one bull. The code notes what may be termed the composition of the herd. It says:—"The maer [bailiff] to have the heifers, the steers, the stirks, the sheep, the goats, and all that shall be found in the house, except the horses, oxen, large cattle, gold, silver, and furred clothes." "Large cattle" may be a reference to a white breed, as we have all the animals of the black breed—heifers, steers, stirks, and oxen—already separately noted. The Saxons, we are told, rode on bulls, and at Shobington, in Bucks, they are said, according to tradition, to have charged the Normans on bulls. Again, it is said that eight of the Saxons rode into William the Conqueror's camp on bulls, from which exploit comes, we believe, the surname of Bullstrode. The Scotch surname Turnbull has also a legend regarding its origin. The colour of these animals is, unfortunately, not stated.

The practice of enclosing forests is said to have been introduced by the Normans, yet in the Welsh laws we learn that there are "three thieves subject to a camlwrw [a fine in compensation for damage]—a dog stealer, a stealer of garden herbs, and a stealer of a wild animal out of an enclosed park land." In this connection, one section of Canute's Forest Laws is interesting as given in John Manwood's translation, 1592—

"27. Besides the wilde beastes of the Forest, there are other wilde beastes, which so long as they are remaining within the bandes and limittes of the Forest they are subject to the punishment of the Lawes of the Forest: such are, wild Gotes, Hares, and Conies. And there are also diuers other wilde beastes, which although they do live and remaine within the bounds and limits of the Forest, and are subject to the charge and burthen of tbe Regarders of the Forest, yet they cannot be accounted or taken to be of the Forest: such are wilde Horses, Bugalls, wilde Kine, and such like."[1]

What is a forest; at least, in what sense did the early authorities use the word? The 3rd Report of the Historical MSS. Commission states, that among the Marquis of Bath's papers there is a sixteenth-century treatise on forest law which sets itself to explain "What difference is between a forest, a chase, a warren, and a parke;" and the 2nd Report of the same Commission states, that among the Earl of Mount Edgecumbe's papers is—*The Boke of Forest Laws*, by William Fletewood, also written in the 16th century; and it begins—"A forest is a territory of certain ground properly bounded and meered." A later authority states that—"A forest comprehends in it a chase, a park, and a warren, and was a territory of woody grounds and fruitful pastures, meered and bounded with irremovable marks, meres, and boundaries. The wild beasts of the forest were five in number—the hart, the hind, the hare, the boar, and the wolf." If a park then be only a part of the territory within a forest, and helped to make up a forest, how comes it that it is claimed for our park cattle that they ranged through forests, and when a section of it was fenced they were enclosed in the park by the enclosure made? How comes it also that white cattle are not mentioned among the wild beasts of the forests along with the hart and hind, boar and wolf? It certainly is difficult to know what were the animals found in forests, as many editors take liberties with the original text. Take, for example, Fitzstephen's

[1] Canute's Forest Laws, as in Harrison's *Description of England*, 1577—"27. Sunt aliæ (præter feras forestæ) bestiæ, quæ dum inter septa et sepes forestæ continentur, emendationi subiacent: quales sunt capreoli, lepores et cuniculi. Sunt et alia quàm plurima animalia quæ quanquam infra septa forestæ viuunt, et oneri et curæ mediocrium subiacent forestæ, tamen nequa quam censeri possunt qualia sunt equi, bubali, vaccæ et similia." This clause has the marginal note—"*Bubali olim in Anglia.*"

description of the forest near London. He wrote in the twelfth century as follows:—"Proxime patet ingens foresta, saltus nemorosi, ferarum latebræ, cervorum, damarum aprorum et ursorum sylvestrium." Then an editor added—"Variantes lectiones alii taurorum."

Sparke, who edited Fitzstephen in 1772, states that the reading "ursorum" was rejected by Stow, Hearne, and Leland. Giles, who is stated to be the best editor of Fitzstephen, has, in place of "ursorum," *tauri sylvestres*. According to the original, Fitzstephen's reference is to bears, or it may be intended for Urus if the spelling be slightly altered, but there is no indication that *tauri sylvestres*, which really means half-wild domesticated cattle, was ever intended. Still, writers quote Fitzstephen as an authority on wild forest bulls. Matthew Paris says, in his *Lives of the Abbotts of St. Albans*, that in the district of the Chilterns there were wolves, boars, stags, and *tauri sylvestres*, and the last are said to be forest bulls. But we have no indication of colour, or whether these animals were feral or purely wild. In the *Life of St. Robert* (A.D. 1200), published by the Roxburgh Club, there are the following lines:—

"He graunte hym ane that wytles raued;
He had hym to hys forest fare,
And syke, a cowe take the thare,
I halde hyr wyld, maik thou hyr tame."

I think this shows that the "wyld" forest cattle were not wild enough to be regarded as feral, unless the Hungarian cattle of to-day be also considered to be feral—for each of these animals has to be tamed and broken into work when taken from the herd, which roams free and unrestricted on the plains. The wild "cattel" of the early writers, I venture to think, were like the cattle on Hungarian plains or on American ranches. They were at first free, and had to be broken in. The unknown author of a MS. on "Husbondrie," of about 1420, writes:—

"A shorter waie—the wilde oxe with the tame
Yyoked be, to teche him howe to doo."

Now, his "wilde oxe" was neither white nor ferocious, for the author describes him as follows:—

"Whoos frounte is crispe and glaade, large eres are,
Thaire lippes and thair een blacke as geet,
With hornes stronge and streght is goode to gete.

* * * * * * * * *

The body thourgh yheered, thicke and breef,
The rede coloure is best, and broune is leef."

In the same century in which the above was written, we have evidence that cattle wandered about freely, and that dark colours were in favour. From the 5th Report of the Historical MSS. Commission we learn, that in 1471 the Corporation of Lydd, Kent, as the King was coming there, "Payd for one crye to have catell owte of the feldys—1d.;" and in 1490 it is recorded that by the will of Alice Kokyred she "leaves her sister her *best cow* of *browne* colour."[1]

Coming to direct references to white cattle, I may first note that Mr. R. E. Lofft, in the sale catalogue of the Troston Hall white polled cattle (24th May, 1895), says that "there is an apparent probability that the polled varieties of white cattle were selections of the monks," and that "there are numerous records of their having been kept in the monasteries."[2] Some of these records are peculiar; but first we note what may be considered as a gastronomic one. We read of "the great feast at the entronization of the reverende father in God George Nevell, Archbishop of York, and Chauncelour of Englande, in the VI. yere of the raigne of Kyng Edwarde the fourth. And first, the goodly provision made for the same." As regards "the goodly provision," the following entries will suffice:—

"In Oxen, ... Ciii.
Wylde Bulles, ... VI.
Muttons, ... M.
Veales, ... CCCiiii.
Porkes, ... CCCiiii.
* * * * *
Stagges, Buckes, and Roes, ... VC. and mo.
Porposes and Seales, ... XII."

It will be noted that here we have "oxen" and "wylde bulles" both entered, though colour is not noted. Assuming that the "wylde

[1] In 1434 Roger Borton, of Hackney, Middlesex, left "Agnes my dowghtur my Don Bullock" also "my red Bullock," along with "a pot of bras of a galon."

[2] The Rev. W. J. Loftie, the well-known authority, writes me "that there is a reference somewhere to a breed of white cattle kept by the Premonstratensian Abbot of Coverham."

bulles" were white, yet I think the entry only means that "oxen" stands for salted meat, and "wylde bulles" for fresh meat. But the monks did require white bulls for sacrificial purposes. We are told that "the monks of Bury St. Edmunds, in Suffolk, spread it abroad that if a barren married woman would come with a white bull to the bier of St. Edmund and make her offerings and vows, she would presently afterwards conceive with child." This is simply the old pre-Christian sacrifice for barrenness, which usually was two white bulls fastened together by the horns. The white bull at Bury St. Edmunds was adorned with garlands of flowers between his horns, ribbons, etc., and was led by the monks in procession through the streets, the lady or woman following, stroking him all the time. It is stated that eminent women of England, and ladies from beyond the seas, came to make this sacrifice. The following entry supports this statement:—

"1474. 2nd June. . . . . did, in the presence of many credible persons, offer at the bier of the glorious king, virgin, and martyr St. Edmund, at Bury aforesaid, one white bull, according to the ancient custom, to the honour of God and the said glorious martyr, in relief of the desire of a certain noble lady."

That a white bull for this sacred use might not be wanting when required, the tenants of the abbey lands were obliged to find one always in readiness. Leases are extant, dated 1487, 1519, and 1533, in the names of Simon, Richard, and Robert and John, in which there is the following clause:—"and the said ———, his executors and assigns, shall find, or cause to be found, one white bull every year of his said term, as oft as it shall happen that any gentlewoman, or any other woman, out of devotion, or vow by them made, shall come to the bier of the glorious king and martyr St. Edmund, to make their oblations of the white bull."[1] Here we find the monks actually placing a premium on the breeding of horned white sacrificial bulls. Is it not probable that it is the

[1] According to the Fourth Report of the Royal Commission on Historical MSS.—"It happened that, in the year 1164, Ailred, the Abbot of Rievaux, was on a journey in Galloway, and was at Kirkcudbright on the festival of the Saint (St. Cuthbert), from whom the place is called. On this occasion *a bull of fierce temper was brought to the church as an oblation*, and was baited in the churchyard by the young clerics."

descendants of these animals that we now call the wild forest breed?[1]

Some tenants in former days had to pay a white bull as a fine. At Lodebrook, Warwick, tenants had to pay "swarf-money," laying it in a hole; "if it be not paid, he giveth a great forfeiture, thirty shillings and a white bull."[2] The white bull appears in another form—for instance, at Marlborough, Wilts, every freeman, by ancient custom, gave to the Mayor at his admission a couple of greyhounds, two white capons, and a white bull. On the arms of this town there are a bull, two capons, and three greyhounds.

At Bitton it is stated in the *New History of Gloucestershire* (1779), that a peculiar agricultural custom formerly prevailed. Three proprietors owned three meadows; one of them had to place in his meadow "a white bull;" the second, "a black boar;"

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[1] Mr. Edward Peacock, F.S.A., has favoured me with the following notes on this subject:—

"WHITE BULL. Mantery of Saint Edmund's Bury.

"Among the lands with which the sacrist's office was endowed were those of Haberdon, the tenants of which were bound to provide a white bull as often as any matron of rank or other female should come, out of devotion, to make what were called the oblations of the white bull at the shrine of St. Edmund. On this occasion the animal, adorned with ribbons and garlands, was brought to the South gate of the monastery, and led along Church-gate, Guildhall, and Abbey-gate streets to the great West gate—the lady all the time keeping close to the animal. Here the procession ended. The bull was returned to its pasture, and the lady made her offerings at the shrine, in the hope of becoming a mother."—Dugdale, *Monasticon Anglicanum*. Ed. 1846, vol. iij., p. 133, col. 1, n.

A lease setting forth this service, dated 1533, is given on p. 169, vol. ij.; also mentioned in *Notes and Queries*, first series, vol. viij., p. 1.

I may add that G. R. Forlong, in his *Rivers of Life* (vol. ii., p. 281) writes—"The newly married ladies of Oxford once pressed forward to kiss the altar stone, after they had led up towards it with much caressing a white bull, kindly provided for such necessities as theirs by a countryman."

[2] Mr. Peacock again favours me with the following notes:—A fine of a white bull is mentioned, but I do not know in what connection, in Delisle, *Classe Agricole*, p. 235.

Certain parishes pay a fine to the Lord of the Manor of Knightton, co. Warwick. "The fine for non-payment was, in the olden time, one pound for every penny not forthcoming, or else the forfeiture of a white bull with a red nose, and ears of the same colour."—G. L. Gomme, *Primitive Folk Moots*, p. 110.

and the third "a black stone horse" (stallion), after which the meadows became common to all stock in the parish or district.

Animals, coloured somewhat like the present "forest breed," seem to have come into favour at one time. In *The Boke of Husbandry* (1534) we are told "concerning cows or heifers," that they should have good horns, wide foreheads, black eyes, and blackish lips. It is also stated "they also approve of those as very good that are of a yellowish colour, and have black eyes, as being of a generous breed."

Some interesting information can also be gleaned from Conrad Gesner's *Natural History*. This work was published in 1551, with a supplement dated 1554. It is full of illustrations, many of them coloured when issued from the press. Herbestein is referred to in the Appendix, but we may note that *Res Moscoviticæ*, which was issued in 1549, contained no illustrations. Gesner colours *Bos and Vacca*, and *De Tauri* reddish brown, and *De Uro* brown; and of the latter he writes, "*colore et figura tauri.*" Gesner also writes about *De bobus Feris Indiæ*, *De Bonaso*, *De Bisonte*, and *Boves Sylvestres*. In the Appendix [1] Gesner treats of *De Uro* and *Bison* again, the Urus being coloured dark, with no black points; the Bison having black eyes and muzzle. Then he has *De Bisone albo Scotico*, and the illustration shows no black points at all, while the head and horns of the *Bonasi* are simply those of the *Bos primigenius*. Gesner's information regarding *Uri* and *Bisonis* came, apparently, from Vienna, and of the *Bovis Scotico* from Glasgow.[2] Reference has been made to the probability that "park cattle" were kept for fresh meat. We gain some idea of farming economy of the past from Tusser (1557). He tells us that

> "For Easter, at Martilmas hange up a biefe;
> For pease fed and stall fed, play pick-purse the thiefe.

[1] Appendix Historiæ. Quadrupedum uiuiparorum et ouiparorum Conradi Gesneri. Tigurini. (1554). De Vro, p. 2; Bison, p. 4; De Bisone albo Scotico, p. 4; Bonasi (ut conijcimus) Caput ad scleton expressum, p. 5.

[2] Uri et Bisonis, Vuolfgangus Lazius Viennensis medicus, historicus, et a consilius potentissimi Romanorum regis Ferdinande es.

Bovis feri Scotico et canum Scoticorum nil Britannicorum trium generum, vir genere nobilis et literarum cognitione nobilior, Henricus A. S. Clare, metropolitanæ ecclesiæ, Glasguensis in Scotia, Decanus per doctrissimum urum loannem Ferrerium Pedemomanum.

With that and fat bakon, till grasse biefe come in,
Thy folke shall loke cherely when others loke thin."

The cattle were kept out in the fields, and Tusser tells us to

"Give cattell their fodder, the plot drie and warme;
And count them, for miring or other like harme.
* * * * * * *
They calves then that come between new yere and lent,
Save gladly for store, lest thou after repent,
For all thing at that time that cold feleth some,
Shall better beare colde when the next winter come."

What these animals got to eat show us why "grasse biefe" was preferred and hung up for winter use. They got

"Rie strawe, then wheate, and then pease;
Then ote strawe, then barley, then hay if thou please."

These ordinary cattle may in a sense be considered forest and wild cattle. Barnabe Googe, in the *Four Bookes of Husbandry* (1577), informs us that a herdsman was necessary for every 20 or 30 "bullockes and kine." The herd when small, "and feeding not farre of, is brought home every day, chyldren and young folkes are able to serve the turn"; yet, where the numbers are great, "and must be kept night and day in Forestes and wylde fieldes," they can only be herded "be men of lusty age, strength, and diligence."[1] In Googe's "Thirde Booke Entreating of Cattell," some of the opinions expressed by "Euphorbus the Netheard" are worth noticing. He says:—"What colour in horses count you the best? The poet seemeth to mislike the white, which others, again, as I have sundry times heard, commende, especially in England, where they are wel accounted of, and most esteemed." Then he goes on to say with reference to oxen that—"The best were counted in the olde time to be of the breede of *Albania*, *Campania*, and *Toscani*: at this day we take the best kinde to be in Hungary, Burgundy, Frisland, Denmarke, and in England" (Appendix I.). It is rather remarkable, I think, that in 1577 it should be stated that white cattle were most esteemed in England, and that they should be

[1] In the time of the Tudors it was essential for a man of substance to have herds of cattle and flocks of sheep ready at hand for the supply of his great household and retinue. Husbandry he might give up—stock-farming he had to continue.

compared with some of the best known white domesticated breeds of cattle on the Continent.

Harrison, in 1577, also writes as follows regarding our cattle :— "In like manner our oxen are such as the like are not to be found in anie countrie of Europe, both for greatness of bodie and sweetnesse of flesh, or else would not the Romane writers have preferred them before those of Liguria. . . . . Their hornes also are knowne to be more faire and large in England than in anie other places, except those which are to be seene among the Pæones, which quantitie, albeit that it be giuen to our breed generallie by nature, yet it is now and then helped also by art. . . . . Certes, it is not strange in England to see oxen whose hornes have the length of a yard or three foot betweene the tips, and they themselues thereto so tall, as the height of a man of meane and indifferent stature is scarse equall vnto them."[1]

From this description we learn that the cattle of England were large in body, and were long-horned. If the reference to the Pæones be taken as a guide, then the cattle here referred to must have been like the Hungarian ox of the present day, and would be white in colour. Harrison's reference to the "wild and cruell buls" of Scotland is especially interesting. He writes :—"They had in like sort no lesse plentie of wild and cruell buls, which the princes and their nobilitie in the frugall time of the land did hunt, and follow for the triall of their manhood, and by pursute either on horsse backe or foot in armor ; notwithstanding that manie times they were dangerously assailed by them. But both these sauage cretures [lions and bulls] are now not heard of, or at the least wise the later scarselie known in the south parts."

When these animals existed, Scotland must have enjoyed the same sport which in Spain has degenerated into the modern bull-fight. The animals now used in the bull-ring in Spain are

[1] Describing England in 1592, Jacob Rathgeb wrote :—"About midday we came upon a fertile country, where there were little low hillocks, and a fine breed of splendid large oxen, and countless numbers of sheep." . . . . "Of tame quadrupeds, it has beautiful oxen and cows, although not so big as the Burgundy cattle, but they have very large horns, are low and heavy, and for the most part black."

considered to be the true descendants of the wild bulls killed by Spanish knights (Appendix II.). The history of the El Raso del Portillo herd, which furnishes the best bulls for the ring, can be traced back to the fifteenth century. Vast herds of the fierce, wild, or rather feral cattle, from which the animals for the bull-fights are drawn, roam to-day in a semi-wild state in the forest districts of Portugal and the southern part of Spain, south of the Guadalquivir. These animals are generally of a uniform colour—black—but sometimes they have white patches. The ploughing oxen of Spain are also black or dark-coloured, and are horned like our Kyloes.[1] If the bulls hunted in Scotland[2] were like those in Spain, and from the prevalence of black colouring amongst our native breeds we may fairly assume that such was the case, the white breed can only be regarded as a domesticated curiosity.

Harrison further writes—"I haue read of wild bores and bulles to haue beene about Blackleie, neere Manchester, whither the said Prince (Henry I.) would now and then resort also for his solace in that behalfe, as also to come by those excellent falcons then bred thereabouts, but now they are gone, especiallie the bulles,[3] as I have said alreadie." . . . . "As for the plowing with Vres [Ures], (which I suppose to be unlikelie), because they are (in mine opinion) untameable and aekes (elks), a thing commonlie vsed in the east countries; here is no place to speake of it, since we want these kind of beasts."

A Friar Bartholomew, about 1360, wrote a work entitled *De Proprietatibus Rerum*, which has appeared in many English editions. He tells us—"Of all kinds of tame beasts, some be found wilde, as a wilde man, a wilde Foxe, wilde horses, wilde Hounds, and wild Swine." It is strange that cattle—bulls or cows—should

[1] The Andalusian breed is either pure black or pure red. These are the colours most abundant in the province of Cadiz: spotted black and white coming next, then spotted red and white. These cattle carry their horns at right angles from the head, and have the ends curved slightly upwards.

[2] At the baptism of James VI. [1566-67] in the chapel of Stirling Castle, we are told that the representatives of Queen Elizabeth were entertained with "the hunting of the wild bull" in Stirling Park.

[3] In the time of King Stephen, near Walton on the Naze, wild cattle were found in the forest and hunted, but both cattle and forest were swept away in the time of Henry I.

not be noted in this list. Further, we are told that "oxen with straight hornes be accompted excellent in worke, and blacke oxen with lyttle hornes be accounted lesse profitable to working." Here we note "blacke oxen" is a term employed with a wide general meaning, and that big-horned cattle were in request. In one of the editions of this book, "Balman uppon Bartholome, his booke, De Proprietatibus Rerum 1582," we obtain some examples of the use of the term "wild." "Some bulls be wilde, fierse, and sterne, . . . and those bulles be red in colour, . . . and may not be taken but in deepe pits and caves." . . . "*Cowe.*—If they range without a Heard, they were wilde, so that Heardes maye not tame them," . . . . "and kine lyue in companye, and be ofte lost, if they goe out of companye, for then wilde beasts eate them."

Bartholomew, who, as already noted, wrote in 1360, says that the German wild ox (the Urus) was in colour black or red, with long strong horns. Balman, writing in 1582, says there are no wild oxen. The following are the two passages in question :—"In Germania be wilde oxen with so long horns, that ye Kings boord is served with drink thereof; for he holdeth so much, as Isi saith, and is a beast of great strength, and may not be tamed, but with an yron ring put through his nose-thrill, by the which ring he is led about; and is black or red, and is thin haired, with hornes; and his forhead is beclypped with full strong hornes, and his flesh is good not onely to meate, but also to medicine." To this is added the following sixteenth-century editorial note by Balman :—

"*Additio:*—There are no wilde oxen, but either Bulls, Buffells, or females of that kind; this is a tame errour, the author meant the furious buffell of the greater kinde, called Uro or Tarando."

It will be seen from this that, in the sixteenth century at any rate, special meanings were attached to the words oxen, bulls, and buffells, and I gather that the term oxen was restricted to those animals that had their neck in the yoke. Yet other writers do not restrict the word oxen in this sense. In *The Countre Farme*, published in 1600 (a translation of *L'Agriculture et Maison Rustique*, published in 1593), we are told how "to imparke wild beastes," and we read of "Buffles (buffaloes), wild oxen, and wild Bulls. We also read of "wilde cattell;" but this term includes

"hares, wilde goates, or fallowe deere, wilde swine, and such other like wilde beastes." In this book we are also told that "wilde oxen, which are called in Prouence and Languedoc brans or branes, are not fit for anything by reason of their great furiousnes and wildnes, except onely for the shambles: such oxen are brought up in the fennie places of Laruargues and upon the sea coast, far from the haunt of other beastes or walke of man." Wild oxen in this sense are animals bred for beef, and from the following passage we gather that in colour they were not white, but most probably would be "of a red haire" or a "blacke." The writer of *Countre Farme* says—"Though in France the red colour be euer most preferred, yet as Serres [a French writer] also affirmeth, the blacke is fully as excellent; for the red exceedeth, but in prouing an extraordinarie vertue in the milke,[1] but the blacke is euer the hardest, best flesht, best tallowed, and hath the strongest hyde."

Coming to English books on English animals, in the early part of the seventeenth century, three important works were published within the space of ten years. The first was Leonard Mascall's *First Booke of Cattell*, published in 1605; the second, Ed. Topsell's *Historie of Foure-footed Beasts*, published in 1607; and the third, Gervase Markham's *Cheape and Good Husbandry*, published in 1614. In the first of the three books named, Mascall's *First Booke of Cattell*, we find "certaine generall rules of oxen." To give three examples. First, they must be "with long hornes somewhat blacke;" secondly, "the dewlappe or skinne that hangeth under his throat, to be great in hanging almost downe to his knees;" and third, "his colour to be redde, or blacke is best." Then we are informed of "the manner and way best for a man to tame his oxen." One way recommended is to "yoake him to wild bullockes that haue not laboured before." It is well to note the sense in which the word "wild" is here employed. The wild

[1] Dalyell, in *The Darker Superstitions of Scotland*, 1835, p. 431, says:—"A prejudice against white cows has subsisted among the peasantry of Scotland, on account of the alleged inferiority of the milk. But its true source may be in some remote superstition, regarding the lawfulness of consuming the product of a consecrated animal."

After the above, Dalyell quotes several authorities on the veneration of white cattle, and then at p. 433 he writes—"Possibly a prejudice in Scotland for red cows, from the superiority of the milk, originates in superstition likewise."

bullock was not white, because this colour is the worst, according to Mascall, who writes—"For oxen to labour, the blacke ox and the red ox are best, and the browne or greezeled ox are next; the white ox is worst of all colours." Mascall further writes—"Wilde oxen are better to beare a burden then to labour, for they are never so free nor so strong to drawe and labour as the tame oxen are." Wild oxen here seems to mean "pack oxen." Once again the various races are noted, Mascall stating that there are "many diuersities in the beasts, as in Italy, in Capam, there they haue white oxen, and of small body, yet verie good to labour in the plough and till the ground. Also, in the Dutchy of Urben, there are great oxen, both white and red, mightie of body and of a great courage. In Tuscane and about Rome the oxen are well set and thicke, and strong made to labour. Likewise in the Alpes and hils of Burgony they be strong and can well endure all labour, and faire likewise withall."

I think Mascall's references to races of white oxen show that those familiar with English cattle in his day were also familiar with the prominent white breeds on the Continent. As I note further on, during this century the flesh of a "white wild ox" was considered in England a suitable present for one nobleman to give another.

Ed. Topsell, in his *Historie of Foure-footed Beasts*, gives illustrations of the skull and horns of the "Bonassus," according to the three drawings of "that excellent Phisitian of England, Iohn Cay." These are the skulls and horns of the *Bos primigenius*, and are similar to those given by Gesner. Of the bull, Topsell writes—"They are plentiful in most countries, as is said in the discourse of oxen; but the best sort are in Epirus, next in Thracia, and then Italy, Syria, England, Macedonia, Phrigia, and Belgia." Of the "Ure-ox," which is "of a reddish colour," he writes that "they are a kind of wilde oxen, not differing from the vulgar but in their colour, and a spotted strake or line, which goeth al along their backs; and those ure oxen are kept as it were in parkes and chases." Here we have the distinct statement that the oxen kept in "parkes and chases" were "of a reddish colour."

In Gervase Markham's *Cheape and Good Husbandry* we get evidence as to the colour of "English cattell." From the way he

writes, it is evident that Italian cattle and the cattle of "other forraine countries" were known in England, and their virtues extolled by "other authors." Markham writes:—"You shall understand, then, that of our English cattell (for I will not speake of those in Italy and other forraine countries, as other authors doe, and forget mine owne) the best are bred in York-shire, Darby-shire, Lancashire, Staffordshire, Lincolne-shire, Gloster-shire, and Somerset-shire, though they which are bread in York-shire, Darby-shire, Lancashire, and Stafford-shire are generally all blacke of colour; and though they whose blacknesse is purest and their haires like veluet are esteemed best; they haue exceeding large hornes, and very white, with black typpes; they are of stately shape, bigge, round, and well-buckled together in euery member, short-ioynted, and most comely to the eye, so that they are esteemed excellent in the market, those in Lincolne-shire are the most part pyde, with more white then the other colours; their hornes little and crooked; of bodies exceeding tall, long and large, leane, and thin thighed, strong hooued, not apt to surbaite, and are indeed fittest for labour and draught. Those in Somerset-shire and Glocester-shire are generally of a bloud-red colour, in all shapes like unto those in Lincolne-shire, and fittest for their uses."

* * * * * * *

"The use of the Cow is two fold—either for the Darie or for breed. The red Cow giueth the best milke, and the blacke Cow bringeth forth the goodliest Calves."

The use of the term "cattell" is rather misleading, if we restrict it to the sense now common among us. I have shown that it included other animals besides the bovines. When we read, under date 1605, of a place "replenished with cattell both tame and wild," we are apt to think that bovine animals are alone meant, when really "cattell," in this instance, should be read as "animals." But in the 17th century cattle that were called "wild" did exist, and were exported. In the *Calendar of State Papers* (Domestic Series), time of Charles I., there are the two following entries. The first, dated 1632, February 11th, is as follows:—

[Officers of the Navy to the Lords of the Admiralty.]

"The Earl of Rutland, to prevent the trouble of shifting the beasts, in another passage described as 'wild cattle,' into a 'shouler' vessel in

their passage to Antwerp, has resolved to land them at Ostend; the writers have therefore taken up a ship for the purpose, and contracted for freight, provisions, and fitting of partitions for each beast apart. They are to be received at Tower Wharf on Wednesday next, and the whole charge is £50. [*One page. Nicholas endorses the letter as relating to the transport of 'the wild cows.'* "]

The second entry is under the date 1632, February 18, and is to the following effect:—

"Minutes by Nicholas of business to be transacted by the Lords of the Admiralty. The business of the Saltpetremen; Captains' names to be presented to the King [delivered to Sec. Coke]; letter of Officers of Navy respecting the transport of wild cows."

What were these "wild cows?"—were they of the white breed? This, of course, is both possible and probable. We have heard of "wild cows" in different lands. For example, Leslie, in *De Origine, Moribus, et Rebus Scotorum* (1678), says that herds of *Vaccæ* frequented the mountainous districts of Argyle and Ross (Appendix III.). But the wild cattle that in this instance were exported to Belgium may have been simply what would now be termed ranche cattle. From the *Calendar of State Papers*, (Domestic Series), time of Charles II., we learn that cattle ranged freely, and were branded. Under date August 12th, 1671, Gulielmus [Fuller], Bishop of Lincoln, writes—"In my visitation of Leicestershire I met with such an odd kind of disturbance among the people that it startled me very much. A strong report ran like wildfire all over that county, and others adjacent, that all cattle of whatsoever kind which were not branded the King would seize upon." . . . "It is reported (how true I know not) that the Duchess of Newcastle was very severe in punishing those of the forest in Nottinghamshire, taking away all the cattle that were not branded, as legally they ought to be."

Under date August 20, 1671, Sir William Hartopp, in a letter about the alarm in Lincolnshire, writes—"Many thousands of cattle were marked, and it came about (according to the best intelligence) from some forest lands, where it was a custom to mark their cattle."

Forest lands may have been common grazing ground, and cattle would therefore require to be branded so as to be distinguished. The modern ranche is our equivalent for the seventeenth-century

forest lands; and *forest cattle* then were as much domesticated as our *ranche cattle* are now.

The entry I have quoted regarding the Earl of Rutland's shipment of "wild cows," I think, refers to a white breed, as from the extract I now quote from the *Report of the Historical MSS. Commission—Duke of Rutland's MSS.*, I think it probable that about this time the Earl may have disposed of his white park cattle. Under date 4th August, 1669, Lord Chaworth writes to the Countess of Rutland:—"I have made boulde to presentt your Ladyship a small taste off a white wilde oxe from my Parke—killed by my owne hand. I had not præsumed so much but that I have heard my Lorde off Rutland saye they were orrigin-ally his att Beskewood Parke, from whence I had that breed.' Beechwood Park was enclosed or "paled" about the time of Edward III., and when Lord Chaworth got his animals would be, I think, when the others went to Belgium. Sending a "taste" of beef seems to have been a favourite method of making gifts. We find in the same report thirty-six years later (22nd December, 1705), a letter from Lord Gower to the Duke of Rutland, in which he states that he "is sending a brace of Trentham oxen for a 'Xmas present." He does not add, however, like the former present giver—"Killed by my owne hand."

At a later date we see the influence of a "fancy" for white colouring still at work—

> "Five hundred white stots I'll gie you
> If ye'll let Hughie Græme gae free."

The change in colour seems to have been easily accomplished, according to a Northumbrian saying noted in *The Durham Tracts*—

> "The red bull of Berrington
> Gaed oure the hills to Hurrington,
> And knock'd its head atween twae stanes,
> And came milk-white back again."

We have also an early reference to a dun cow, which has been regarded both as mythical and yet historical. I refer to the animal slain by Guy Earl of Warwick—

> "A monstrous wild and cruel beast
> Called the dun cow of Dunsmore heath."

In folk-lore, at least in Scotch folk-lore, I have noticed that bulls and cows are black. We have references to the "Black Cow of Germany," the "Black Bull of Norway," and such sayings as "the black bull has trodden on your feet."[1] Even Grimm asks—"What can the black cow mean in the following phrases :—'The black cow crushes him,' 'The black cow has trodden on him?'" Setting aside the question of meaning, the special colour must have been the universal one, or it must have been the colour of the "wild" bulls and cows. In connection with the superstition regarding bulls' heads there is, or rather must have been, one in Scotland, which, if it could be explained, might help us now as regards the origin of wild bulls and white bulls. Between 1440 and 1631, there are many instances in Scottish history, where a bull's head was employed as a token of death. Why should a bull's head be a token of death? Was it the head of a white sacrificial bull? Bulls, white and black, have found their way into heraldry. I have taken the trouble to look through a standard work on crests, and I find 13 crests with a Demi Bull, 1 with a Bull's leg, and 330 with Bulls, sometimes borne winged, and Bulls' heads and horns. Of the latter, 57 per cent. are argent and 43 per cent. sable. The white bulls thus preponderate, and in many cases these white bulls are marked to show ears, tip of horns, hoofs, and point of the tail, sable. If these crests were taken or obtained for slaying a wild bull, then these animals must have been both white and black.

There are many points of view from which our subject can be studied, the physiological, osteological, and archæological. If our authorities, scientific and antiquarian, would give the matter some attention, perhaps we would be better able to solve the problem. I have endeavoured to indicate its many sidedness as far as I can, but, of course, a personal survey, without aid, must be subject to many limitations. I would, for instance, say that many points could be noted by those interested in our old texts—in Folk Lore and in local histories. In Ossian's Poems, for example, we read—

[1] Heywood, in 1562, wrote :—

"The blacke oxe neuer trode on thy foote :
But the dun Asse hath trode on both thy feete
Which Asse and thou, may seeme sproong of one roote :
For the Asses pace and thy pace are meete."

"Long had they strove for the spotless bull that lowed on Golbun's echoing heath;" and again, "I went and divided the herd, one snow white bull remained. I gave that bull to Cairbar." Here two things are to be noted—first, a spotless bull was much desired; and secondly, snow white bulls were found in herds, not wild. Much, I think, could be learnt from a study of old Irish or Celtic texts. In the Irish epic of the Tain bo' Cuailgne, there is recorded a contest between two bulls. One is the East Doun or brown (dark) bull of terrific size and strength, and the other the Finnbennach or white horned. The latter is described as—

> "An ox was this white-headed, white footed,
> Savage, red, blood-red,
> As though he were dyed in red,
> As though he were bathed in blood,
> As though he were rubbed in crimson."

Again, in the *Folk Lore Record* for 1893 we read of a County Tyrone tradition of a terrible wild roan bull, called the "Roan bull of Orange." In fact, as far as I am aware, none of these traditional terrible bulls are ever stated to be white in colour. That my view of the use of white cattle is not a new one, I may note that Dr. R. C. Maclagan, of Edinbnrgh, in sending me some valuable notes (Appendix IV.), writes—"To explain my position, I took the view which I see you favour, that white cattle were kept for a religious purpose, and hoping some day to propose this theory, I made some notes."

As I have already mentioned the sacrificial instinct up to a recent date has existed in this country. About 1864 we learn that, in Morayshire, when a herd was attacked with murrain, one of them was sacrificed by being buried alive as a propitiatory offering. In Cornwall also, about 1800, farmers sacrificed living animals to appease "the wrath of God." Forlong, in the *Rivers of Life*, states that Sir James Simpson told the Society of Antiquaries of Scotland in 1861 that he had personal knowledge of a cow being burned alive within twenty miles of Edinburgh as a sacrifice to the "field-deities."

Another example of the old sacrificial custom is seen in the custom of roasting whole, on a wedding day, bullocks with gilt horns.

The employment of white oxen seems to be common in ceremonials in all parts of the world. At the Great Ploughing

Festival in Siam, before which no one would think of commencing his work, the ceremonial plough is pulled by two cream-coloured bullocks. These animals are made much of, for after ploughing they reveal which crops are to be most plentiful by the preferences they show for baskets of various grains placed before them. Again, at the Wine Festival of Vevey, held every 50 years in the Canton of Vaud, and which will be held again in 1903 (a special occasion), there are symbolical pageants, one to Pales, the goddess of flocks and herds, and another to Ceres, goddess of harvest. At the last festival in 1889, the chariot of the youthful goddess Pales was drawn by two milk-white bulls, crowned with flowers and blue ribbons. The car of Ceres was drawn by two black oxen. Both cars are preceded by high priests, musicians, and others, some in long white robes and togas, others in short white tunics with the short cloak and hood, which the Romans called *lacernæ*. All this indicates that this festival is the survival of a Roman religious pageant. Mr. J. S. Stuart-Glennie, an authority on folk lore, in an article entitled "Where Beasts are Baptized," has pointed out that to this day customs are observed in South-Western Brittany which date back to the remotest ages of paganism. Every autumn, in September, the peasants bring their cattle to Carnac and go through two ceremonies themselves without the supervision or interposition of Christian priests. First, holding their beasts by ropes thrown round their horns, they, in the evening and darkness, go to the western door of the Church of St. Cornély, above which is a statue of the old Pagan god, the protector of animals, transformed into a Christian saint and pope. Here, in silence, holding their beasts, they kneel and pray, *i.e.*, repeat or mutter the immemorially sacred magical words. After this, they lead their cattle to a tree-embowered sacred fountain and there pour its water over their beasts. On Sunday, after vespers, the clergy go down in procession to the Sacred Fountain of Animal Baptisms, and, facing northwards, read a prayer or prayers. On the Tuesday following takes place the autumnal sacrifice of the beasts. In the forenoon the beasts to be sacrificed by the peasants are first blessed before the church door by the Bishop of the Diocese, who also sprinkles them with holy water. After this, the priests arrange a procession to the place of sacrifice, leading the way themselves,

followed by the peasants and beasts that have been blessed. Now-a-days the sacrifice takes the form of an auction (formerly they were burnt), the auctioneer being a churchwarden standing by the side of the banner of St. Cornély. This yearly custom in Brittany supports me in the views I have already expressed, that a study of the folk lore of this country, coupled with a study of the ceremonials, festivals, and traditions of the church, will afford us a satisfactory explanation why white cattle have been carefully preserved, so that we yet find them preserved in parks.[1]

Such, then, is the historical evidence I have been able to gather. The white breed which we are in the habit of calling "park cattle" and "white cattle" can only be the descendants of a domesticated breed let loose, for they retain and possess all the useful properties of domesticated cattle as permanently as the wild horses of the savannahs of South America and the steppes of Tartary now do, and we know that these horses are descendants of the domesticated horse let loose.

Modern authorities on live stock agree in stating that the Scotch Highland, Welsh, Kerry, Devon, and Sussex breeds represent very ancient types, and that they are without historical

[1] I trust I may be pardoned if I note here what Mr. J. G. Frazer, of Cambridge, the learned author of *The Golden Bough*, writes to me on the subject of the theory I have advanced as to the origin of park cattle. He says:—"Your theory of the descent of British white cattle from the sacred white cattle of our pagan forefathers, strikes me as ingenious and by no means improbable. It is quite in harmony with what we know of the tenacity of religious custom and tradition under many changes of outward form. But apart from this general consideration, I do not know of any positive evidence (beyond what you mention) which supports the theory. You are no doubt acquainted with Pliny's account of the use made of white bulls by the Druids in cutting the mistletoe (*Nat. Hist.* XVI., § 250).

"With regard to the distinction between white and black victims, the ancients sacrificed white victims to the deities of the upper, and black victims to the deities of the nether world, as also to the dead (K. F. Hermann, *Lehrbuch der gottesdienstlichen Alterthümer der Griechen*, § 26). Among savage and barbarous peoples black victims are sacrificed to procure rain, and white ones to procure sunshine (*Golden Bough, I.*, p. 17 *seq.*; the examples there given might be added to), the colour of the victim being obviously selected with reference to the black rain clouds and white sunshine.

"I am afraid that this is all that I can say as to your ingenious hypothesis and in answer to your inquiries."

improvement, other than was effected by special attention to useful properties in stock selected for breeding. These breeds may have been as good many centuries ago as they are now, and of the same type in times long past as at the present day.[1] On the other hand, we cannot but agree with the opinion expressed by Professor Owen (*re* Chartley cattle), but which we think is applicable to all the white herds, namely, that they are descended from domestic, or rather domesticated cattle, introduced by the Romans, which became half-wild from breeding together for many years in an unreclaimed state.

We may take it as settled that the Urus had projecting horns and a self-coloured dark coat with a stripe of white along the back. Now in the old Craven breed of Longhorns, the horns projected almost horizontally, though the present English Longhorns have long spreading and sometimes drooping horns. Though the colour of the breed varies a good deal, there is always the white mark along the back. Some of the Irish cattle also, which two or three decades ago were so largely brought to this country as stores, were identified by the long white mark along the back; so

[1] Sir Ernest Clarke, the Secretary of the Royal Agricultural Society of England, in delivering a series of lectures on Agricultural History before the University of Cambridge in 1899, is reported, in the second of the series, to have discussed in detail the question of the breeding and fattening of live stock in the latter part of the 17th century, and to have adduced evidence to show that the carcases slaughtered at Smithfield were not, as stated by M'Culloch, and, on his authority, by Macaulay, "diminutive" as compared with the present day. He showed, according to the *résumé* in our hands, that M'Culloch had quoted from Sir Frederic Eden, Eden from Sir John Sinclair, and that none of them had appreciated the exact significance of tables compiled by the famous economist, Charles Davenant, in a rare pamphlet of 1710 in the British Museum. As a matter of fact, there was reason for thinking that the carcases sold at Smithfield in 1710 were as heavy as those of the present day; though they did not, of course, "cut up" so well as those of modern times. One of the great aims of the famous breeder Bakewell was to "get beasts to weigh where you want them to weigh" in the roasting instead of the boiling pieces; and the object of all rearers of cattle had been to get shape rather than size, and quality rather than quantity. Instances were given from books of the period, and especially from Defoe's Tours, as to the size of oxen and sheep of the day, and the lecturer concluded this part of his subject by stating that those who fondly clung to old traditions might, he thought, console themselves that "the roast beef of old England" was not absolutely a myth.

that if we want to look for the characteristics of the Urus (*Bos primigenius*), we must look elsewhere than to the white park cattle which lay claim to be its descendants.

The source of origin of the present English herds of white cattle is probably Scotland, and, therefore, I think that the history of the Scotch herds should be studied first, and I intend to give it special attention, but here again I must depend upon the work of the historian, archæologist, and folk-lorist. For instance, to take one example, a number of stones with bulls incised have been found at Burghead, in Elgin. To what do they refer, and have similar stones been found elsewhere? The statement has been made that the present herds of white cattle in England are of Scottish origin. Illustrations to bear out such a statement were given in Part 1A, and I would add now the following:— Dr. Chas. Leigh, in his *Natural History of Lancashire, Cheshire, and the Peak of Derbyshire* (1700), thus describes the Middleton herd—"In a park near Bury, in Lancashire, are wild cattle belonging to Sir Ralph Ashton of Middleton. These, I presume, were first brought from the high-lands of Scotland. They have no horns, but are like the wild bulls and cows upon the Continent of America." Again, in *The Natural History and Antiquities of Northumberland*, by John Wallis (1769), it is stated that "In the park of the Right Honourable the Earl of Tankerville, at Chillingham, there is a species of wild white cattle, of a diminutive size, said to have been first brought from the Highlands of Scotland, but at what particular time cannot be remembered." Further, Leonard Jenyns, in his *Manual of British Vertebrate Animals* (1835), notes under "Bos"— "a wild breed (Bewick, Quad., p. 38), formerly met with in Scotland, but now extinct, said to have been characterized by their white colour, with the muzzle and ears black."

The British Museum Natural History authorities do not seem to have accepted the white cattle as indigenous, for in Leach's Systematic Catalogue (1816),[1] under the "List of the indigenous

[1] "Systematic Catalogue of the specimens of the indigenous Mammalia and Birds that are preserved in the British Museum, with their localities and authorities, to which is added a list of the described species that are wanting to complete the collection of British Mammalia and Birds." By W. G. Leach. Dated British Museum, Aug. 30th, 1816.

Mammalia and Birds that are wanting to the British Museum," is the following entry :—" Mammalia—Red Ox."

There are two authorities in this country who have devoted a considerable amount of time and attention to the study of the oxen of the country—wild and domestic, namely, Professor M'Kenny Hughes and Professor Boyd Dawkins. With the former I think I am most in agreement, and it would assist all interested in oxen if Prof. M'Kenny Hughes would publish the data I believe he obtained in Russia respecting the westerly migrations of men and cattle. With Prof. Boyd Dawkins I am also in agreement, so far as he discards the indigenous theory regarding the origin of our park cattle, for, if I am not mistaken, he considers that our white breeds were originally introduced into this country in a domesticated condition from the continent. Prof. M'Kenny Hughes suggests they are of Italian origin, but with this suggestion Prof. Boyd Dawkins does not agree. I am, however, inclined to think that Prof. Hughes's suggestion can be supported, and will be found to be the most feasible solution to the problem. It is rather unfortunate that the Urus has been termed *Bos primigenius*, as many are misled by this, and regard it as a sort of "Adam and Eve" of the bovine race, especially of all the races and varieties of what we term now the *Bos taurus*. But it does not occupy such a position, and is simply a species itself, not entitled to any more regard than the *Bos longifrons*, its contemporary. I believe there have been two distinct migratory streams westwards of black cattle and white cattle. The black or dark cattle, if with projecting horizontal horns and a white stripe down the back, being able to trace descent from the wild ox or Urus—the white cattle being of eastern origin. Two such streams met in Friesland, and the black and white Holstein-Friesian dairy cattle is the product, and such is their traditional origin also.

We have not, however, progressed far enough in our inquiry to draw deductions, and what I have been able to gather together must be regarded more as a preface to the subject of our study than anything else. I have compiled a bibliography, which also is incomplete, but may be of interest and service to those desirous of studying the question. I think I have indicated in both parts of my paper what my personal views are, yet I would ask that

they be not taken as final, for there may be some circumstance which I have overlooked that may lead me to alter these, yet I do not think they can or will be very materially changed. One point I would like to emphasize is that in such an inquiry as this regarding the origin and history of a race of cattle, my position must be that of a compiler dependent upon workers in departments of study far removed from each other, and without any special interest in cattle; so I have, therefore, to ask that those who can assist the inquiry, either by fresh data or constructive criticism, will do so. This paper must not be considered as final, or even as introductory, but simply as a preliminary collation of data.

APPENDIX I.

With reference to Italian cattle, Professor Italo Giglioli, of Portici, writes me that "it is very evident that very little is known regarding the history of the different breeds of Italian cattle; these are, no doubt, the descendants of the ancient cattle of classical times, but the many invasions of barbarians during the downfall of the Roman Empire have certainly mixed and modified the old breeds; and if we compare the paintings and sculptures still existing of ancient cattle with the modern Italian cattle, we find very many differences, granting that the ancient artists were faithful in their representations of animal life."

"In Tuscany to-day, I may add, we find five breeds of cattle, *i.e.*, the Chianina, Maremmana, Tiberina, Svizzera, and Montanina. The first three named are said to be descendants of the breed called Podolico or Pugliese, from Puglia, in the South of Italy. The Svizzera came from Lugano, in Switzerland, and the Montanina are nondescript mountain cattle.

"For many centuries the Val de Chiana (Tuscany) has been celebrated for its white cattle. The breed called Chianina, or Val de Chiana, are white in colour, with muzzle and tip of tail black; the tongue dark; ears flesh-coloured inside; the horns long, fine, and black tipped.

"The Maremmana breed are grey and white speckled in colour, and are found on the salt marshy plains of Volterra and the clays of Sienna. They are a working breed. The Tiberina breed differs little from above; and the Svizzera breed, black in colour, are

found only in the vicinity of Pisa. In Venetia—the seaboard and alpine province of Udine (the ancient Friuli)—the cattle are an indiscriminate mixture of all the neighbouring races—Tyrolese, Styrian, Carinthian, and Belanese, grafted on the local animal, known as Friulanci, it itself being one of the numerous varieties of a race of animals that now predominates in every part of Italy.

"This is the typical race of South-eastern Europe, which has two sub-divisions—first, the Hungarian-Transylvanian, and secondly, the Podolian-Moldere. Tyrolese oxen are first brought while young into the province of Brescia (Lombardy) and thence scattered over the plain under the name of Brescian oxen. These animals are short-horned, of a greyish-white colour, and have the characteristics of the Podolico race. They are tall and white skinned, and the best come from Merano and Lana, in the Tyrol. Oxen are also brought from Emilia into the provinces of Cremona and Mantua, but those of the Tyrol are preferred.

"In northern Italy there is the Piedmontese or Carmagnolo race—tall of stature, short-horned, and greyish-red in colour. Emilia (or its northern part, about Piacenza) has a specific type, called Bardigiana, in colour red or mottled with white, and long-horned.

"In the plain towards Parma, the Reggiana or Parmense race is found. These animals are regarded as the type of the large races bred on the central plains of Europe, but the uniformity of their red coat, without marks, and the thick, short-limbed body, are considered proof of its antiquity. Italian zoologists assert that it is descended from the ancient *bue Italico*. In the Udine province, and in parts of Parma and Piacenza, there is a breed with a uniform coat of red or reddish-brown, amber-coloured horns and hoofs, rose-tinted lip and nostrils, and white eyelids, and they are regarded as the relic of an aboriginal race.

"South of the Taro, and extending beyond Bologna, is the Pugliese breed. In the province of Verona the Pugliese breed is almost exclusively found. In the province of Belluno there is the Bellunese breed, which is like the Tyrolese in having short curved horns and a uniform colour, but while the shade of the Tyrolese is tawny and whitish, the Bellunese is decidedly grey.

"In the province of Treviso there is a medley of sub-races, all

variations of the Podolian; and in the province of Vincenza the Podolian balances the other types. The Podolian is the exclusive race in the rest of Italy south of the Po.

"Piedmont has a pure breed, called 'Pianura'—the colour of the Piedmontese and mixed breeds being light grey. The mountain breed already referred to are brown, black, and white spotted."

APPENDIX II.

Mr. Oswald Crawfurd, who is an authority on Spain, writing in *The London Review* on bull-fights, says:—"It was once the noblest sport in the world: it is now the most brutal, the meanest, and the most sordid. It was once the sport of knights, noblemen, and princes to chase the cattle of the great plains of central Spain, lance in hand. No sport was finer, for the semi-wild cattle of Spain came of that primogeneous stock which once peopled Europe. They are a small breed, but enormously strong, active, and swift. They gallop like a deer, leap dykes and hedges like a hunter, and turn and double like rabbits. They are exceedingly fierce when roused, and they are very easily roused, and their sharp *forward-bending horns* are a terrible weapon of offence. No stranger on foot dares to come near the herd on the plains, and a mounted man needs a good horse, a safe seat, and sharp spurs to get away from these savage beasts. To kill such an animal from the saddle required all a knight's skill with the spear, and all his courage. Ruy Diaz de Bivar, el Campeador, the semi-mythical hero of mediæval Spain, is reported to have killed a bull with his own lance in the open plain, unaided by his companions. The Emperor Charles the Fifth is chronicled to have done the same, and the sport was continued in the same heroic fashion by well-mounted knights and gentlemen till the beginning of the eighteenth century."

Mr. Sydney Gowing, another authority, writes to me as follows:—"With regard to the Spanish bulls, I have never seen a white one, either in the ring or on the plains, and do not think there are any. The usual colours are black, chestnut, sandy, tawny. bay, and so forth, occasionally piebald. By white, I mean pure white. What are called 'pepper-and-salt' bulls are common."

APPENDIX III.

In Bishop Leslie's [1526-1596] *History of Scotland*, as translated by Father Dalrymple (1596), and edited by Father Cody for the Scottish Text Society in 1888, it is stated that at "Tor Wod" [Caledonia silva] "in quhilke onlie, eftir the commoune speiking, was the quhyte kye fund of quhilkes now restes verie few or nane."

Bishop Leslie also refers to cows or cattle, which lived in a semi-domesticated state, yet were sent "throuch all partes of the realme" to be "sauld," as their flesh was of "a meruellous sueitnes, of a wounderful tendirnes, and excellent dilegatnes of taste." Perhaps these cattle were white in colour and are the source of origin for our Scotch Park Cattle. Bishop Leslie, as translated, writes:—"In the mountains of Aargyle, in Rosse lykwyse, and sindrie vthiris places, ar fed ky, nocht tame, as in vthiris partes, bot lyke wylde hartes, wandiring out of ordour, and quhilkes, throuch a certane wyldnes of nature, flie the cumpanie, or syght of men: as may be seine in winter, how deip saeuir be the snawe, how lang saevir the frost ly, how scharpe or calde how evir it be, thay nevir thair heid sett vndir the ruffe of ony hous. Thair fleshe of a meruellous sueitnes, of a woundirful tendirnes, and excellent dilegatnes of taste, far deceiues the opiniounis of men, that nevir tasted thame: bot quhen thay ar sodne thair fatt is sik, that aftir the maner of the fatt of vthir ky, it freises nocht frahand and congeilis, bot certaine dayes remanes vnfrossin lyke oyle. Bot quhen al of this sort ar mekle commendet than cheiflie ar thay that out of Karrick [Latin Carectonia] ar sent vnto vs. Thair herdis keipis the ky: bot the oxen not, except ane with ilkie draue: for thay till the ground with horses, quhen thir sorte, in the sumer tyme thairfor ar weil fed. In wintir quhen thay ar throuch fatt, and throuch fatnes weil bowdin [swollen], throuch all partes of the realme thay ar sent to be sauld: and being slane, thay ar poudiret, or with salte ar seasoned vnto the neist summer, to be keepet frome corruptione to thair commoune vse of daylie fude, as swyne fleshe is vset in vthir cuntries, of quhilke our cuntrie peple hes lytle plesure."

APPENDIX IV.

Dr. Maclagan, in an interesting communication, favours me with the following notes:—

"CORMAC'S 'GLOSSARY.' Whitley Stokes (edition 1868, p. 72).—'As Fachtna son of Sencha said' . . . 'I have a right to three *dirnas* of silver in addition for three white cows, for each shapely cow between the scales of Lugba beautiful to the eye, profitable. This, then, was the appearance of the cows of Echaid Echbèl from Scotland, which Curui captured (from the Ulstermen), *i.e.*, white cows, with red ears.'

"Another edition of the Glossary adds—'these cows, then, of Echaid Echbel used to come to graze from Ard Echdai Echbeil from Scotland into the province of Dalriada, and they used to be in Seimne Ulad. Curoi, however, carried them off by force from the Ulstermen.'

"'THE EULOGY OF SAINT COLUMBA.' Whitley Stokes (see *Revue Celtique*, vol. xx., p. 251).—'Three white cows,' as Fachtna of the just judgments uttered this decree, saying 'I award three *dirnas* of silver, between Lugba's scales, for them, for three white cows, with the same form as the erca (of Iuchna Echbel), beautiful to the eye, a profitable contract.'

"That is, Fachtna adjudged three *dirnas* of silver for three white red-eared cows in the likeness of the three cows of Iuchna Horsemouth (these famous cows were captured by Cu-roi), because *erc* means 'cow,' and *ferb* 'cow,' and *lannoir* 'cow,' *ut dicitur*.

"Iuchna's cows (*erca*), savage the kine, in destroying them Luar fell; coming out from his house the grave of Loeguire the Victorious was found.

"'REVUE CELTIQUE,' Vol. I., p. 261.—'Then a Bull-feast is made by them there, so that they might know thereout unto whom they should give (the) kingdom.

"'Thus used that Bull-feast to be made, to wit, a white bull to kill and one man to eat his fulness of his (the bull's) flesh and of his broth, and sleep to him under that fulness, and *or* (?) of truth to say over him by four druids, and by him in vision used to be seen the kind of man who should be made king there, from his shape and from his description, and the kind of work he was doing.

"'The man awoke from his sleep and makes known his dream to the kings. To wit, a young champion, noble, strong, with two red girdles over him, and he above (the) pillow of a man in sickness in Emain Macha.' *Ib.*, p. 46.

"You will notice that those religious uses of white cattle go back to the foundations of Irish story, and are the earliest notices of such occurrences.

"I am almost sure that other old Irish texts mention white cattle, unfortunately, if I am right in this supposition, I have mislaid my notes."

I may add that, according to Cormac's "Glossary," *Cana* is a name of a grade of poets who had 60 stories to repeat, and *emain* was the name of their poetry, for which the fee was "two good coloured cows."

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NOTE.—My indebtedness to many authorities for aid afforded me in compiling this Bibliography is very great; and to them collectively and individually I beg to tender my sincerest thanks.

R. HEDGER WALLACE.

Reports on Excursions.

The Crannog at Dumbuck was visited on 29th October, 1898; CALLANDER on 3rd April, 1899; MILNGAVIE and the BANKS OF THE ALLANDER on 22nd April; BOTANIC GARDENS, Glasgow, on 6th, QUEEN'S PARK on 22nd, and ABERFOYLE on 24th June, but nothing of special interest falls to be recorded, except the remarkably profuse display of blossom upon trees and shrubs in Queen's Park.

CRIEFF, 26th September, 1898 (Glasgow Autumn Holiday).—By permission of the Earl of Ancaster, a party of twenty visited Drummond Castle grounds, near Crieff, celebrated for its formal garden. Mr. Richard M'Kay acted as conductor. The only flowering plant of special interest that was met with was *Rumex Hydrolapathum*, Huds., which was plentiful within the grounds and in a stream outside, reaching the height of seven feet. The woods showed conspicuous traces of recent storms, many thousands of trees having been blown down—one, a Silver

Fir (*Abies pectinata*, DC.), 18 feet 3 inches in girth of trunk at 4 feet 3 inches from the ground, was blown down in November, 1893, and a section of the stem is preserved in the castle. This tree was 90 feet high, 210 years old, and contained 1,010 cubic feet. The stump has been set up in its old position, and is being preserved. Among other trees measured were—an Ash, 12 feet 9½ inches in girth at 5 feet; a Beech, 18 feet 10 inches at 4 feet, bole 7 feet; an Oak, 15 feet 2 inches at 3 feet 7 inches on upper and 7 feet 2 inches on lower side, bole 14 feet; another Oak, 14 feet 7½ inches at 4 feet on upper and 7 feet on lower side, bole 14 feet.; a Lime (*Tilia vulgaris*, Hayne), 13 feet at 5 feet, bole 20 feet. The following Fungi were collected by Mr. Wm. Stewart:—

Agaricus (*Amanita*) *excelsus*, Fr., *A.* (*Amanita*) *rubescens*, Pers., *A.* (*Amanita*) *vaginatus*, Bull., *A.* (*Armillaria*) *melleus*, Fl. Dan., *A.* (*Clitocybe*) *infundibuliformis*, Schæff., *A.* (*Clitocybe*) *laccatus*, Scop., *A.* (*Collybia*) *radicatus*, Rehl., *A.* (*Collybia*) *dryophilus*, Bull., *A.* (*Pluteus*) *cervinus*, Schæff., *A.* (*Entoloma*) *jubatus*, Fr., *A.* (*Clitopilus*) *prunulus*, Scop., *A.* (*Pholiota*) *spectabilis*, Fr., *A.* (*Pholiota*) *mutabilis*, Schæff., *A.* (*Inocybe*) *rimosus*, Bull., *A.* (*Flammula*) *sapineus*, Fr., *A.* (*Crepidotus*) *mollis*, Schæff., *A.* (*Psalliota*) *silvaticus*, Schæff., *A.* (*Hypholoma*) *sublateritius*, Schæff., *A.* (*Hypholoma*) *capnoides*, Fr., *A.* (*Hypholoma*) *epixanthus*, Fr., *A.* (*Hypholoma*) *fascicularis*, Huds., *A.* (*Hypholoma*) *lachrymabundus*, Fr., *A.* (*Psilocybe*) *agrarius*, Fr., *A.* (*Psilocybe*) *semilanceatus*, Fr., *A.* (*Psathyra*) *corrugis*, Pers., *A.* (*Panœolus*) *papilionaceus*, Fr., *Cortinarius elatior*, Fr., *Paxillus giganteus*, Fr., *Hygrophorus pratensis*, Fr., *H. coccineus*, Fr., *H. ceraceus*, Fr., *Lactarius blennius*, Fr., *L. quietus*, Fr., *L. serifluus*, Fr., *Russula adusta*, Fr., *R. rubra*, Fr., *R. cyanoxantha*, Fr., *R. heterophylla*, Fr., *R. fœtens*, Fr., *Boletus flavus*, With., *B. chrysenteron*, Fr., *B. edulis*, Bull., *B. versipellis*, Fr., *Polyporus giganteus*, Fr., *P. adustus*, Fr., *P. versicolor*, Fr., *Thelephora palmata*, Fr., *Stereum hirsutum*, Fr., *Calocera viscosa*, Fr., *Lycoperdon gemmatum*, Fr., *Peziza aurantia*, Œd.

It may be recorded here that, two days before, Messrs. John Renwick and Richard M'Kay visited Ochtertyre grounds, and measured the following trees:—Ash, 20 feet 11½ inches in girth at 4 feet on upper and 12 feet on lower side. On this tree were growing a small *Acer Pseudo-Platanus*, Linn., and a *Sambucus*

nigra, Linn ; a Horse-chestnut, near old Castle, 12 feet 4 inches at 3 feet 3 inches on upper side ; an Oak, 15 feet 9½ inches, at 2 feet 8 inches on upper and 6 feet on lower side, bole, 10 feet.

Edinburgh, 6th May, 1899.—A joint excursion took place on this date with the Edinburgh Field Naturalists' and Microscopical Society. The Mushroom Tunnel (three-quarters of a mile long) at Scotland Street was visited and explored with the aid of oil lamps, but the result was disappointing. The mushroom-beds were few and far between. The proprietor, who accompanied the party, stated that owing to a blight which appeared some time since he intended to give the mushroom-beds a rest for a while. A similar place for mushroom culture had been secured near Dundee. The effect of the blight, which seems to have been a parasitic micro-fungus, was very evident, more than a half of the mushrooms seen being diseased or malformed. The party afterwards set out for the Botanic Gardens, where a pleasant hour was spent. Worthy of notice is the Insectivorous Plants house, the large blossoms of the Sarracenias being very fine. Before leaving Edinburgh our section of the party was kindly supplied with a cup of tea by the Edinburgh Society. We had only a small party, but the Edinburgh contingent was a large one. Mr. S. M. Wellwood (Hon. Secy.) acted as conductor.

Eglinton, 27th May, 1899.—A party numbering eighteen turned out to the excursion on this date to Eglinton Castle grounds. The road through the town of Kilwinning was taken, and continued through the "Corshill," which was the town in the days of the Abbey, and was separated from it by the river Garnock. An Elm-tree (on the side of the railway, opposite Kenneth's brickwork) which has corky excrescences on many of its branches, was examined. Within the policies a number of trees was measured. Mr. John Renwick has prepared a useful table (see page 399), which contains measurements of notable trees in this neighbourhood taken at different periods. A Beech was pointed out with the date 1843 or 1848 carved on it. The

first, second, and third figures were quite normal in shape, but the last letter had been widened out to three times its original size. The Simple-leaved Ash near Lady Jane's Cottage was visited. It had not begun to leaf for the season. The bark differs from that of the common Ash in being smoother. This tree is becoming thickly covered with Ivy. Mr. John Smith conducted the party.

KILMALCOLM, 10th June, 1899.—The district between Kilmalcolm and Langbank was visited on this date, but there was a very poor turn-out of members. Prof. G. F. Scott-Elliot acted as conductor. Among flowering plants noted were *Ranunculus hederaceus*, Linn., *Sagina subulata*, Presl., *Potamogeton pectinatus*, Linn., *Carex limosa*, Linn., *C. vulgaris*, Fries, *C. rostrata*, Stokes, *C. canescens*, Linn., *Ornithogalum umbellatum*, Linn., naturalised, *Saxifraga hirta*, Donn., established. Fungi noticed were *Coleosporium sonchi*, Pers., *Uromyces alchemillæ*, Pers., *Æcidium grossulariæ*, DC. The green alga *Chætophora tuberculosa*, Hook., was observed.

INNELLAN, 5th August, 1899.—A joint excursion took place on this date with the Geological Society of Glasgow, and was fairly attended. The Geological Survey of Scotland recently published a *Memoir of the Geology of Cowal*, chiefly the work of Mr. T. C. Clough, M.A., F.G.S., and the object of this excursion was to examine a very small part of this district—viz., the section as it is exposed between Innellan and Dunoon. This section begins a little to the south of Innellan Pier, near the place that a fault has thrown down the Upper Old Red Sandstone, which is still preserved between Innellan and Toward. The first part examined was a crush-breccia of green serpentine, the pieces of serpentine reaching 9 or 10 inches in diameter. The origin of this serpentine is not easy to explain, but probably it was derived from a former igneous augite-bearing rock. Proceeding towards Dunoon, bed after bed of schists, evidently of sedimentary origin, is passed over, all of them so much metamorphosed that the original derivative has been entirely lost, having been converted into greywackes and phyllites. The rocks between Innellan and Dunoon are nearly

all of this character, intercalated here and there with bands of limestone which has also undergone severe metamorphism, rendering it schistose. This metamorphosed limestone is even more folded and contorted than the other schists. Near the Bull Rock the greywacke is quarried for building purposes. In many places the schists are cut through by basalt dykes running in a N.N.W. direction. The geological map shows that these dykes run up against a broad east-and-west dyke, coloured dark crimson. The Castle Hill, Dunoon, is at one end of this broad dyke. From this point it crosses the country to Loch Striven and Loch Fyne. The Geological Survey has shown this broad dyke to be older than the small dykes, as the latter intersect it at places, but the age and superposition of the schists, except that they are certainly not later than Silurian, are not determined. Mr. Joseph Sommerville, Vice-President, acted as conductor.

Newmilns, 26th August, 1899.—On the afternoon of this date Mr. Andrew Gilchrist conducted a very small party to Lanfine Estate, near Newmilns. The estate is finely situated, and is extensively planted with a great variety of ornamental trees and shrubs. Among native plants seen may be mentioned *Impatiens Noli-tangere*, Linn., *Epipactis latifolia*, Auct., *Carex pendula*, Huds.

Proceedings of the Society.

SESSION 1898-99.

27th September, 1898.

Mr. Peter Ewing, F.L.S., Vice-President, in the chair.

Mr. Richard M'Kay reported on an excursion to Drummond Castle, Crieff (see page 457), and exhibited *Rumex Hydrolapathum*, Huds., from that neighbourhood.

Mr. Wm. Stewart gave a report on the meeting of the Cryptogamic Society at Dunkeld, and exhibited the following

fungi collected in that vicinity:—*Agaricus* (*Lepiota*) *Badhami*, B. and Br., *A.* (*Clitocybe*) *tuberosus*, Bull., *A.* (*Clitocybe*) *odorus* Bull., *A.* (*Pholiota*) *erebius*, Fr., *Cortinarius armillatus*, Fr., *Paxillus giganteus*, Fr., *P. pannoides*, Fr., *Cantharellus, umbonatus*, Fr., *Polyporus picipes*, Fr., *P. adiposus*, B. and Br., *Dædalia quercina*, Pers., *Hydnum zonatum*, Batsch., *H. compactum*, Pers., *Craterellus cornucopioides*, Pers., *Thelephora laciniata*, Pers., *Sparassis crispa*, Fr., *Lycoperdon giganteum*, Batsch. The last named measured 2 feet 5½ inches in circumference. Mr Stewart also exhibited from ponds at Rohalion Shooting Lodge *Pilularia globulifera*, Linn.

Mr. R. Hedger Wallace, the Society's delegate at the fourth International Congress of Zoology, which was held this year at Cambridge, gave a report of the proceedings of the Congress and descriptive accounts of the visits of the members to Tring Museum and Woburn Abbey.

Mr. S. M. Wellwood, Hon. Secretary, exhibited *Scutellaria minor*, Linn., from Bute.

Mr. Thos. Wilson exhibited *Clavaria fusiformis*, Low., from Auchencruive, Ayr.

Mr. R. Hedger Wallace showed a collection of photographs of the famous race of Hungarian white cattle, being type specimens of the various breeds.

The Chairman reported on a three days' visit which he had made to Ben Lawers in July. Vegetation was behind, and plants in flower seemed as if they had reached this condition prematurely. The great cold of June, and the correspondingly great heat of July, might account for this. *Draba rupestris*, R. Br., was plentiful and in good flower. Plants of *Saxifraga cernua*, Linn., were fairly numerous, but most of them were small. *Erigeron alpinum*, Linn., *Veronica saxatilis*, Linn., *Arenaria sulcata*, Schlecht, *Arenaria sedoides*, Schultz, *Draba inflata* (=*Erophila vulgaris*, DC.) were among those in fair flower, while the Hieracia and a few other Composites, and all the Alpine Carices and Grasses, were in a very backward condition. A few plants of *Woodsia hyperborea*, R. Br., were seen, and the two patches of *Cystopteris montana*, Bernh., seem no less than on former occasions. The plants mentioned hereafter were all exhibited at the meeting:—*Sagina Linnæi*, Presl.,

was in fine condition; *S. nivalis*, Fr., was a pleasant sight, and it is many years since Mr. Ewing last saw such large plants. He has no doubt it is overlooked. *Rubus Chamæmorus*, Linn., was in flower, which seldom happens in July. It seems strange that the late Dr. F. B. White had only seen *Hieracium holosericeum*, Backh., in company with Mr Ewing on Sgiath Chrom and Stuc-a-chroin. It is a common plant all along the Breadalbane range, but as a rule leaves the rocks, and prefers the dry heathery knolls. *H. chrysanthum*, Backh., is not given in the *Flora of Perthshire* for Meal Ghaordie, although Mr. Ewing had collected it there in company with Dr. White. *Loiseleuria procumbens*, Desv., is a common plant all over the Breadalbane range, but is seldom seen in flower. Regarding *Pyrola rotundifolia*, Linn., the *Flora of Perthshire* says:—"Often confounded with P. media, the following stations are beyond doubt—Ben Laoigh, P. Ewing; Dunkeld, J. G. Lyon." Though rarely found in flower, the plant itself is not rare among the higher rocks. *Carex filiformis*, Linn., is a rare Perthshire plant, as far as Mr. Ewing can judge from his own experience. *Tetraplodon mnioides*, B. and S., showing the bone on which it was growing, and *Aulacomnium turgidum*, Schwgr., were also exhibited.

Mr. R. Hedger Wallace's paper on "Agricultural Zoology in Great Britain" was held as read.

25TH OCTOBER, 1898.

Mr. Joseph Sommerville, Vice-President, in the chair.

REPORT OF THE COUNCIL (1897-98).

Membership.—The present Membership of the Society is as follows:—

Honorary Members,		13
Corresponding Members,		38
Ordinary Members (Life),	31	
Annual Subscriptions,	229	
		260
Total,		311

Fifteen ordinary Members were added to the roll during the year.

Associates.—One Associate has been added during the year. The number on the roll is 22.

Obituary.—The obituary record for the year contains the names of Sir James Bain (who joined in 1862), Joseph Christie (1882—see pp. 300-1), Alex. Leitch (1885), James M'Call (1887), Gavin Miller (1858), and an Honorary Member in the person of Mr. Osbert Salvin, M.A., F.R.S., F.L.S., F.Z.S.

Meetings.—The usual meetings were held, the attendances being satisfactory.

Excursions.—A number of excursions was carried out. The attendances were rather better than last year.

British Association.—Mr. G. F. Scott Elliot, M.A., B.Sc., F.L.S., F.R.G.S., was the Society's delegate for the meeting held at Bristol.

Finance.—The Hon. Treasurer (Mr. John Renwick) submitted his Annual Statement of Accounts, duly audited. This statement showed a balance in the Society's Ordinary Fund of £75 4s. 5½d., and in the Life Members' Fund of £147. From the balance of £75 4s. 5½d. fall to be deducted cost of publishing *Transactions* for 1897-98 and catalogues, and cost of new bookcases. (See page 478.)

Library.—The Hon. Librarian (Mr. James Mitchell) reported that the number of volumes issued during the session exceeded the record of any previous year. The large additions to the Library having made a new catalogue a desideratum, the Rev. Mr. G. A. Frank Knight kindly undertook to compile one, and it has been completed and issued to the members. The most important addition to the Library during the year was an almost complete set of Reports of the Challenger Expedition. The report acknowledged the good offices of Sir John Murray, K.C.B., LL.D., etc., in this connection, and the debt the Society was under to the Rev. Mr. Knight for the labour involved in the preparation of the new catalogue.

The Reports were all unanimously approved of and adopted.

Transactions.—The Hon. Editor (Mr. John Paterson) reported that, in November, 1897, the *Transactions* for Session 1896-7 were issued, and that the material for the Session which had just closed was partly in the press.

Rev. Mr. G. A. Frank Knight, M.A., Convener of the Museum and Research Committee, and one of the Delegates of the Society

to the preliminary meeting called by the Lord Provost of Glasgow to consider the organisation of the scientific work in connection with the visit of the British Association for the Advancement of Science to Glasgow in 1901, reported on the proceedings of that meeting, and gave an account of what has since been done in the way of advancing the work. At the public meeting a Committee was appointed to "make the necessary preliminary arrangements, especially in connection with the compilation of handbooks relating to the local fauna and flora, the geological phenomena, the archæological remains, the leading industries of the West of Scotland." The Committee, it was agreed, was to consist of the Lord Provost and two representatives from each of the learned and scientific institutions which had signed the memorial, asking the Lord Provost to convene a public meeting, with the addition of representatives from the Glasgow Photographic Associations, and, further, a number of other gentlemen representing Corporations and Trusts, etc., in the city. This Committee was divided into three Sub-Committees, each instructed to prepare a handbook, and the Natural History Sub-Committee was again subdivided into sections to deal with Botany, Geology, and Zoology respectively.

Vacancies in the Council were filled up as follows:—Rev. G. A. Frank Knight, M.A., as Vice-President; Messrs. Anderson Fergusson, Richard M'Kay, Geo. W. Ord, and Professor George Bell Todd, M.B., C.M., as Members of Council for three years. In addition to these newly-elected members, the Council consists of the following:—President, Robert Kidston, F.R.S.E., F.G.S.; Vice-Presidents, Messrs. Joseph Sommerville and Alex. Somerville, B.Sc., F.L.S.; Hon. Secretaries, Messrs. S. M. Wellwood and R. D. Wilkie; Hon. Treasurer, John Renwick; Hon. Librarian, James Mitchell; Hon. Editor of *Transactions*, John Paterson; and Ordinary Members of Council, Messrs. Robert Brown, M.D.; John Fleming, George Russell, G. F. Scott Elliot, M.A., B.Sc., F.L.S., F.R.G.S.; Charles Hogg, David Pearson, and Hugh Boyd Watt.

Messrs. James Jack and William Leighton were re-appointed Auditors.

Mr. G. F. Scott Elliot, M.A., B.Sc., etc., read his Report as Delegate to the last Meeting of the British Association.

On behalf of Mr. James W. White, Mr. Scott Elliot exhibited *Stachys alpina*, Linn. According to Mr. White's notes, this was not known to be a British plant until the summer of 1897, when it was discovered by Mr. Cedric Bucknall (*Journal of Botany*, XXXV., p. 380). The plant occurs on some southern spurs of the Cotswold Hills, about 12 miles north of Bristol, at an elevation of from 550 to 650 feet, and is associated with many of the species that accompany it at its stations on the Continent—viz., *Pyrus Aria*, Sm., *Valeriana Mikanii*, (Wats.), *Campanula glomerata*, Linn., *Stachys sylvatica*, Linn., *Polygonatum officinale*, All., and *Convallaria majalis*, Linn. The Gloucestershire locality is, for the most part, elevated woodland upon Oolite covering the Upper Lias sands. The plant is thinly scattered in clumps through the more open portions of the woods, and along the borders, evidently preferring the sunniest and most sheltered positions. It occurs also in thickets below the woodland, and abundantly on hedge-banks for a considerable distance, the total area being about two square miles. The English plant, according to Mr. White, is taller and more robust than any Continental specimens that he had seen, and larger in all its parts than the other British species. Stem erect, stiff, $2\frac{1}{2}$ to 3 feet high. Lowest leaves *cordate-oval* on long stalks, upper ones sessile, floral leaves large, straight-sided, gradually increasing in size from the terminal tuft downward, dark bronze or purplish-green, very hairy and velvety on both surfaces. Corolla larger and broader than in *Stachys sylvatica*, purplish, blotched with orange and white, woolly outside, and having a ring of oblique hairs within the tube. Whole plant dark in hue, hairy and velvety throughout, and rather glandular towards the top. It flowers at the beginning of July.

Mr. Oswald Fergus, D.D.S., exhibited some abnormalities in the Dandelion, Greengage, and Walnut, and fracture and true union of bones in Grouse, Partridge, and Pheasant, and anchylosis in long bones of last-named. Messrs. S. M. Wellwood and G. F. Scott Elliot, M.A., B.Sc., etc., referred to the frequency of double-headed flowers in the Dandelion, and the Compositæ generally. Mr James Jack exhibited a double-headed flower of *Chrysanthemum maximum*, Ramond.

Mr. Chas. Kirk exhibited an albino Hedge-sparrow (*Accentor modularis* (Linn.)), from Uddingston.

Mr. Chas. Hogg exhibited *Testacella haliotidea*, Drap., from Woodside, Paisley; and Mr. S. M. Wellwood *T. scutulum*, Sowerby, from Rosebank Nurseries, Johnstone. At Rosebank carnivorous slugs had been known to occur for four years, and they have all, with a single exception, been found in the glass-houses.

Rev. G. A. Frank Knight, M.A., read a paper, entitled "Remarks on the British Testacellidæ."

29TH NOVEMBER, 1898.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

Mr. W. A. Donnelly reported at length on the visit of the Society to the Crannog at Dumbuck, and gave a description of the remains and articles of antiquarian interest that had been dug out there. An interesting discussion followed Mr. Donnelly's remarks; and Mr. D. B. Duncanson showed, under the microscope, sections of various timbers taken from the piles of the Crannog.

A rare moss, *Catharinea tenella*, Röhl., sent by Professor E. M. Holmes, F.L.S., was exhibited by Mr. G. F. Scott Elliot. It had been discovered at Gondhurst, Kent, by Mr E. S. Salmon, in company with Sir John Stirling and Mr. W. E. Nicholson. According to Professor Holmes, Mr. Salmon says that apart from the difference in the inflorescence (dioicous in *C. tenella*, Röhl., paroicous in *C. undulata*, W. and M.) it is difficult to separate it from *C. undulata*, var. *β minor*, W. and M. *C. tenella* has, however, the leaves scarcely undulate and dull green. Only the male plant of *C. tenella*, W. and M., has yet been found in Kent.

Mr. W. Anderson Smith, corresponding member, read a paper, entitled "Fish and Fisheries of Chili."

A paper by Mr. James M'Andrew, corresponding member, entitled "Botanical Notes from Galloway for 1897-8," was held as read. (See page 321.)

27TH DECEMBER, 1898.

Rev. G. A. Frank Knight, M.A., Vice-President, in the chair.

Messrs. James Lang, 17 Stanhope Street, and Thomas W. Robertson, 5 Whitehill Gardens, Dennistoun, were elected as Ordinary Members, and Mr Alexander S. MacLean, Greenock, was admitted as an Associate.

Mr. A. Adie Dalglish exhibited *Colias edusa*, Fab., from Stranraer, Wigtownshire, where it had been taken by his brother on the 29th August; *Eupithecia helveticaria*, Bdv., from the banks of the Allander, Milngavie, one of its few British localities; *Phibalapteryx lapidata*, Hüb., which, until recently, had been considered one of our rarest species of British Lepidoptera, and has now occurred on the Lanarkshire, Kilsyth, and Campsie Hills, and in several localities in Argyllshire; *Hydrella unca*, Linn., from Glenfalloch, where it had been first found by him three years ago. The larva of the last-named species feeds on *Carex sylvatica*, Huds. Mr. Dalglish also exhibited *Scopula decrepitalis*, H.-S., which he has taken in several localities on the Loch Goil and Arrochar hills, and also in Glenfalloch. It occurs in the months of May and June, and should be looked for at its food plant, *Lastrea spinulosa*, Presl.

Mr. Thos. Scott, F.L.S., Corresponding Member, read a paper entitled "Notes on some Crustacea from Fairlie and Hunterston." (See page 346.)

Mr. R. Hedger Wallace's paper entitled "White Cattle: an Inquiry into their Origin and History, Part 1B," was held as read. (See page 403.)

Mr. Robert Brown, M.D., read a paper entitled "Zermatt and the Furka—Botanical Work amongst the High Alps." Zermatt, Dr. Brown declares to be one of the most interesting and fruitful fields that could be visited by a geologist or naturalist. In 1898, to which his visit referred, the summer heat was late, and the winter snows, even in August, lay deep in comparatively low places, making it rather difficult to climb and cross situations for work which were ordinarily easy to reach—but the conditions obtaining brought some advantage, by the lateness in flower of many attractive spring plants. Dr. Brown was anxious to work the higher slopes, and he found that the most fruitful area for collecting was between 7,000 and 10,000 feet in altitude. The plants which he exhibited to the meeting were nearly all

gathered in the belt between 9,000 and 10,000 feet. Some plants seem to grow anywhere in these Alpine districts. For instance, *Saxifraga oppositifolia*, Linn., was blooming vigorously on rock-ledges after all other plants had disappeared, and was equally strong and robust in the valley near the village. On the summit of the Furka pass the snow was plentiful, and, the season being late, early flowering plants were still common. Along the slopes here "are fields unlimited for botanical work—a work full of splendid exercise for mind and body, a health-giving and muscle-developing enjoyment to all who love to follow nature, and learn of her in the midst of her solitary grandeur and varying beauty."

In the absence of the Hon. Editor, the Hon. Secretary intimated that the part of the Society's Transactions for last session (Vol. V., N.S., Part II., 1897-98) was now ready.

31st January, 1899.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the Chair.

Mr. Anderson Fergusson exhibited *Arhopalus speciodus*, Say, and *Buprestis hæmorrhoidalis*, Aerbst., South American beetles, which were recently found in this district, probably introduced with foreign timber.

Mr. James F. Gemmill, M.A., M.B., C.M., delivered a lecture on "The Study of Marine Natural History, with special reference to certain living specimens exhibited." A large number of aquaria, with live marine animals, had been brought from the Marine Station, Millport, to illustrate the lecture. Some small aquaria, belonging to Mr. George M'Crie, were also placed on the tables. Those last mentioned were of special interest, as they had all been "established" for long periods. The lecturer gave a short account of the specimens in the aquaria exhibited, indicating the special points of interest in the habits, structure, and classification of each. The concluding portion of the lecture was occupied with a discussion of some of the questions, which are still unsolved, regarding the life-history of the common Limpet, especially with reference to reproduction, and bearing on the general question of the differentiation of sex, in the animal kingdom. A number of microscopic slides, relating chiefly to the

development of the Limpet, was also shown. A cordial vote of thanks was accorded to Dr. Gemmill and Mr. Alex. Gray, curator of the Millport Marine Station, who assisted him. There was a large attendance of members and friends.

28TH FEBRUARY, 1899.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

Messrs. Robert Garry, 2 Hill Street, Garnethill; Alexander Gray, Marine Station, Millport; Robert Henderson, 12 Armadale Street; and Alfred J. Steven, 54 Albert Drive, Pollokshields, were elected as Ordinary Members.

Mr. James Rankin, M.B., C.M., B.Sc., delivered a lecture on "Physiology as a Factor in Evolution," which was illustrated by lantern slides. The lecturer dealt with the theories of Lamarck, Darwin, and Weismann, expressing himself favourably concerning that of Lamarck, who held, *inter alia*, that new organs appeared in response to a "new need or want which continued to be felt," and also in favour of the hereditary transmission of acquired characters. He reviewed at length Weismann's theory of the "continuity of the germ-plasm," and quoted evidence from more recent observation and experiment which showed that the increase of our knowledge of the behaviour of cells under certain conditions tended to discredit that hypothesis. He stated that while it was difficult to prove the transmission of acquired morphological characters, yet in the phenomenon of instinct, or hereditary memory, in the lower animals, we had an example of the transmission of acquired mental traits. Dr. Rankin pointed out that in unicellular animals all the physiological functions necessary to life were carried on, and that these differed in degree only, not in kind, from those of the highest animals, and also that in all probability the qualities shown by the highest animals were present, at least potentially, in the lowest. There is an evolution of the cell as well as of the individual, and in the lowest groups of animals many of the cells remained in an indifferent condition, and were thus extremely plastic, responding readily to physiological pressure from within and to changes in external conditions. To this plasticity of the cells, to physiological necessity, and to the influence of surroundings the lecturer attributed the radial

symmetry or segmentation of many cœlenterates, and stated that a similar arrangement of organs was to be found in some primitive flat-worms, while some of the turbellarians showed distinct segmentation or repetition of corresponding organs. He expressed the opinion that segmentation was not likely to arise *de novo* in highly-differentiated forms, and that the main line of descent of the vertebrates was everywhere composed of segmented animals. He mentioned that the ascidians, which he had elsewhere shown did not exhibit segmentation, were probably not in this direct line. After reviewing the "Annelid Theory," the lecturer concluded by pointing out that the repetition of similar parts in animals furnished a wealth of material which nature had utilised in the production of the complex structure of the higher vertebrates. A cordial vote of thanks was given to Dr. Rankin for his lecture. Members of kindred societies and friends of members had been invited to the meeting, and there was a large attendance.

28th March, 1899.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

Miss M. A. M. Kidston, 24 Victoria Place, Stirling, and Mr. Alexander Patience, 2 Golfhill Terrace, Dennistoun, were elected as Ordinary Members.

Mr. James F. Gemmill, M.A., M.B., C.M., showed a mounted specimen of the bones of the pelvis and right leg of a Wood-pigeon, the left leg having been entirely awanting. The case was remarkable, on account of the well-developed condition of the left half of the pelvis, and the presence there of an almost normal acetabular cavity. Dr. Gemmill also showed about twenty malformed young trout, obtained from the hatcheries at Lochwinnoch. Most of the specimens were of the double-monster type, and they formed a series of stages ranging from complete separation of the embryos in the yolk sac to cases in which the two embryos were quite fused together except at the fore part of the head. The large median eye present in some of the latter was specially striking.

Mr. John Lindsay, M.A., M.B., C.M., showed a specimen of the peculiar variety of Gold-fish cultivated by the Chinese, in which the dorsal fins and tail are double.

Mr. Symers M. Macvicar exhibited *Myurium Hebridarum*, Schp., from Moidart. This moss has been found in North Uist, South Uist, Benbecula, Barra, Skye, and Tiree. The specimen exhibited on the present occasion, from Moidart, in the extreme south-west of Inverness-shire, is the first known locality on the mainland. Mr. Macvicar had lately found it in three localities some miles apart, in each instance in the same kind of place—namely, wet, stony ground close to the shore. In the station where it is most plentiful, it occurs in company with *Schœnus nigricans*, Linn., among stones, and on tussocks of *Festuca ovina*, Linn., with Ling heather. Surrounding the tussocks is the wetter ground, with *Hypnum revolvens*, Sw., *H. scorpioides*, Linn., and *Aneura pinguis*, Dum. This species has been said to occur on rocks, but from the localities in which Mr. Macvicar has seen it, he would not call it a rock-plant, as there is always a considerable amount of soil between it and the rock, and in this respect it differs from such a species as *Grimmia maritima*, Turn. Myurium belongs to the Atlantic type of plants, being limited to the west of Britain, the localities above mentioned being the only stations known for it in the British Isles. It is not known from any other part of Europe, but has been found in the Canaries and Azores. Mr. Macvicar thinks that it will probably be found in the west of Ireland when the coast there has been searched further. It grows in compact patches of a few inches in diameter, of a golden-yellow colour, somewhat in the manner of *Leucobryum glaucum*, Schp. The only plant it could possibly be passed over for is *Hypnum cupressiforme*, Linn., var. *θ elatum*, B. and S.; but when once known it is easily recognisable at sight, and under the lens no mistake is probable.

Mr. George W. Ord read a paper on "The Lepidoptera in relation to Flowers. (See page 355.)

The President (Mr. Kidston) showed with the lantern, some photo-micrographs of insects and plants.

Mr. Robert M. Morton gave a lantern exhibit of native plants in their habitats.

25TH APRIL, 1899.

Mr. Joseph Sommerville, Vice-President, in the chair.

Mr. John Lindsay, M.A., M.B., C.M., was elected as an Ordinary Member.

The Hon. Secretary intimated a valuable gift to the Society from Mr. Paul Rottenberg. This consisted of a work called "Beautiful Forms in Nature," which is being issued in parts, under the editorship of Professor Hæckel, of Jena, through whom it had been obtained. On the motion of the Chairman, the Hon. Secretary was instructed to convey to Mr. Rottenberg and Professor Hæckel the thanks of the Society.

Mr. John Renwick reported on an excursion to Callander, and Mr. Richard M'Kay on one to Milngavie.

Mr. C. Sherry sent for exhibition a collection of New Zealand fruits, and also the following:—The fruits of *Poinciana regia*, Boj., *Hura crepitans*, Linn., *Bryophyllum calycinum*, Salisb., a plant belonging to the Crassulaceæ which forms buds on the margins of its leaves; the fungus *Cordyceps Robertsii*, growing on the caterpillar of a species of Hepialus; and the fibre known as "Sisal," or "Manilla," which is obtained from *Agave mexicana*, Linn.

Mr. A. Adie Dalglish exhibited some specimens to illustrate the genus of Lepidoptera, Laurentia of Treitschke.

A paper on "Heronries, Past and Present, in the Clyde Faunal Area" was read by Mr. Hugh Boyd Watt. (See page 378.)

30TH MAY, 1899.

Rev. G. A. Frank Knight, M.A., Vice-President, in the chair.

Reports of excursions to the Mushroom Tunnel and Botanic Gardens, Edinburgh (see page 459), and Eglinton Castle (see page 459), were read.

Mrs. David Robertson, Millport, exhibited *Phæosaccion Collinsii*, Farlow, a marine alga new to the British Flora, from Cumbrae. It was first found five years ago, and in the present year was got abundantly and in fruit. Mr. E. A. L. Batters, LL.D., B.A., F.L.S., to whom it had been submitted, says that it is very strange that a plant which had previously only been found in North America and Greenland should also occur in the West of Scotland.

Mr. S. M. Wellwood, Hon. Secretary, exhibited *Draparnaldia plumosa*, Vauch., *Chætophora elegans*, Roth., *Rivularia calcarea*,

Cooke, *Spirogyra longata*, Vauch. (two forms), *Vaucheria sessilis*, Vauch., and other fresh-water algæ.

Some discussion took place regarding the appearance on Loch Lomond on 26th and 27th April of beetles in extraordinary numbers. The loch from the north end of Inch Cruin to Darroch, and along the face of Inch Fad and Inch Moan, was literally covered with them, sometimes in patches a foot square. Every fish was gorged with them. The patches appeared to be in some cases three or four beetles deep. Unfortunately, the species was not determined.

A discussion also took place regarding the appearance of a marine monster seen by Campbeltown fishermen in the Sound of Kilbrannan.

A paper by Mr. John Smith, entitled "Conodonts from the Carboniferous Limestone Strata of the West of Scotland," with descriptions of six new species by Dr. Jennings Hinde, was read. (See page 336.)

27TH JUNE, 1899.

Mr. Robert Kidston, F.R.G.S., F.G.S., President, in the chair.

Reports were given on excursions to Queen's Park, Botanic Gardens, and Aberfoyle.

Mr. R. D. Wilkie, Hon. Secretary, exhibited *Salamandra maculosa*, Laur., *Triton cristatus*, Laur., *Molge vulgaris*, Boulenger, and *Molge palmata*, Boulenger.

Mr. Michael Cuthbertson exhibited some fine cultivated plants from his nurseries at Rothesay.

A paper entitled "Narrative of a Cruise on Loch Fyne, in June, 1899," by Messrs. John Paterson and John Renwick, was read. (See page 366.)

A paper entitled "Meteorological Notes and Remarks upon the Weather during the Year 1898," by Mr. James Whitton, Superintendent of Parks, Glasgow, was held as read. (See page 324.)

1ST AUGUST, 1899.

Mr. Robert Kidston, F.R.S.E., F.G.S., President, in the chair.

A report was read on the Society's excursion to Kilmalcolm. (See page 460.)

Mr. James Murray exhibited the following Mosses:—*Andreæa nivalis*, Hook., *Dicranum fulvellum*, Sm., from Ben Macdhui; *Eurhynchium cirrosum*, Jur., *Cylindrothecium concinnum*, Sch., *Amblystegium curvicaule*, Lindb., *Hypnum Halleri*, Linn. fil., and *H. procerrimum*, Mol., from Ben Lawers.

Mr. L. Watt sent for exhibition some plants from Dumbarton Common. This locality, Mr. Watt says, is perhaps only second in importance to Possil Marsh, near Glasgow. Owing to its low level, it cannot be drained, and some interesting plants have got a firm hold. Among the plants exhibited were—*Bidens cernua*, Linn., which was formerly limited to parts of the Common, now grows all over the soft marshy patches; *Carum verticillatum*, Koch, has become established; *Samolus Valerandi*, Linn., which grows in a muddy patch within the tidal margin of the River Leven; *Juncus tenuis*, Willd., which is found growing along the river both out of and in the water. This plant may be traced all along the River Leven, and Mr. Robert Kidston has found it at the base of Ben Lomond. It is found in soils and under conditions which vary very much, from a saline marsh to a mountain bog. *Scirpus Tabernæmontani*, Gmel., of which there are but a few plants at a corner of the Common furthest from the river, was also exhibited.

Mr. John Renwick read some notes on the larger trees in the policies at Eglinton Castle. (See page 399.)

Mr. John Paterson showed a photograph which he had received from Mr. John Craig, Beith, which illustrated the method adopted by the young Cuckoo in ridding itself of its companions in the nest of its foster-parent.

29TH AUGUST, 1899.

Mr. Peter Ewing, F.L.S., in the chair.

The Hon. Secretary intimated the death of an esteemed member, Mr. George W. Ord, Curator of the People's Palace, Glasgow Green, and read an obituary notice by Mr. Robert Henderson. (See page 319.)

Mr. Joseph Sommerville, Vice-President, reported on an excursion to Innellan and Dunoon (see page 460); and Mr. R.

D. Wilkie, Hon. Secretary, on one to Lanfine, Ayrshire (see page 461).

The Chairman exhibited *Eriocaulon septangulare*, With., from Skye, and *Myurium Hebridarum*, Schp., from Barra; and Mr. R. Braithwaite, M.D., M.R.C.S.E., F.L.S., the author of *The British Moss Flora*, who was present, made some remarks on those plants.

The Chairman also exhibited *Drosera anglica*, Huds., var. *obovata* (M. & K.), from Benbecula; *Poterium Sanguisorba*, Linn., sent by Mr. A. Gilchrist, Darvel; and *Lilium chalcedonicum*, Linn., with a fasciated stem, sent by Mr. M. Cuthbertson, Rothesay.

Mr. Oswald Fergus, D.D.S., L.D.S., exhibited a plaster cast from a Perch caught in Loch Leven, with the lower jaw abnormal.

Mr. S. M. Wellwood, Hon. Secretary, exhibited *Sirex gigas*, Linn., from near Houston.

Mr. R. D. Wilkie, Hon. Secretary, exhibited some interesting plants from the Propagating Houses at Camphill.

Mr. John Orr exhibited *Sambucus Ebulus*, Linn., from Eaglesham.

Mr. Hugh Boyd Watt read a paper entitled "Additional Notes on the Heronries of Clydesdale." (See page 378.)

The Chairman read a paper entitled "Ben Lawers Botanical Notes, 1899," in which he stated that he was not in a position to report very fully on the state of the flora as it appeared towards the end of July this year, as he only had the pleasure of being on it for one day, and the mist was very dense during the eight hours he spent there. He ascended by the western ridge, as his friend, Dr. Braithwaite, wished to work for a few hours in the western ravine.

Juncus trifidus, Linn., was very small this year. Only a very few small plants of *Loiseleuria procumbens*, Desv., were seen. The Ordnance Ravine was very disappointing; it seems either to have been much frequented this year or else the plants are on the wane. *Draba rupestris*, R. Br., was in poor condition, and there were comparatively few plants to be seen. *Saxifraga nivalis*, Linn., is nearly gone, and it is to be feared *S. cernua*, Linn., will soon be a thing of the past. Only three plants two years old were seen; no doubt there were a good many young

plants, but when it is borne in mind that these three plants, or at most twelve plants, are all that are left to make the young plants for the year after next, it is almost safe to conclude that the end of *S. cernua*, Linn., is not very far off. The Gentian Rocks were visited, and here *Myosotis alpestris*, Schmidt, was in fine flower but the plant small. *Veronica saxatilis*, Linn., was in good condition. No hawkweeds were in flower. *Alsine rubella*, Wahl., was plentiful, but the plants were small. Plants of *Sagina nivalis*, Fr., were a fairly good size, and seemed to have been overlooked by previous collectors. *Gentiana nivalis*, Linn., is still to be seen, but a misty day is no use for judging of this plant. The other alpine plants on these rocks are much the same as usual, only it might be said that all mountain vegetation seemed poor this year, which was, no doubt, owing to the cold spell of weather we had during the usual flowering season of these plants; yet, strange to say, *Saxifraga oppositifolia*, Linn., and *Silene acaulis*, Linn., had got the length of shedding their seeds.

Comparing notes with Dr. Braithwaite of his early visits to the Ben there is no doubt that our plants are deteriorating, if not fast disappearing. *Nardus stricta*, Linn., is driving *Alchemilla alpina*, Linn., up the mountain, and the latter is driving *Juncus trifidus*, Linn., on to the cliffs.

A very pleasant day was spent on Creag Mhor, and fourteen hours in the mist on Ben Heasgarnich. This was new ground, at least the side taken was, and it was found to be very rich. Some of the rare Ben Lawers mosses and flowers were got in profusion. *Timmia norvegica*, Zett., and *Aulacomnium turgidum*, Schwgr., were in great plenty. Of *Myurella apiculata*, B. & S., a very rare moss in Breadalbane, a good deal was seen, and if he had only been fortunate with the weather, Mr. Ewing had no doubt he would have been able to show a few rarities.

1897.—Sept. 1.						
To Balance—Life Members' Fund,			£47	0	0	
Ordinary Fund,						
on loan,	£40	0	0			
Do., in Bank,	56	0	0			
	£96	0	0			
Less due to Treasurer,	5	9	5½			
				90	10	6½
				£137	10	6½
1898.—Aug. 31.						
To 197 Members' Annual Subscriptions @ 7s. 6d.,				73	17	6
,, 2 ,, Arrears,				0	15	0
,, 17 Associates' Subscriptions @ 5s.,				4	5	0
,, Interest,				7	12	1
,, *Proceedings* sold,				2	4	11
,, One-eighth Legacy from the late Sir Michael Connal, *less* Tax,				1	2	6
,, Received from Mitchell Library—						
For *Proceedings*,			£3 15 8			
,, Carriage and Wrappers,			1 6 10			
,, *Proceedings* to Foreign Societies,			1 3 0			
				6	5	6
				£233	13	0½

From Balance of £75 4s. 5½d. fall to be deducted cost of *Proceedings* for 1897-98, of Catalogues, and of new Bookcases.

1898.—Aug. 31.						
By Rent and Attendance,				£13	9	6
,, Postage, Stationery, &c.,				16	13	8
,, Printing Circulars,				13	13	6
,, ,, *Proceedings*,				48	12	0
,, Carriage on *Proceedings*,				2	6	8½
,, Carriage and Wrappers Foreign *Proceedings*,				1	6	10
,, Lecture and Lantern Expenses,				4	4	4
,, Subscription to International Zoological Congress,				1	1	0
,, Library—New Books,		£5	0	0		
Binding,		4	0	3		
Insurance, 12s.; Postages, Stationery, &c., 8s. 9½d.,		1	0	9½		
				10	1	0½
,, Balance Life Members' Fund on loan @ 4 °/₀,	*£47	0	0			
,, Balance Ordinary Fund on loan @ 4 °/₀,	*£40	0	0			
,, Balance Ordinary Fund in National Security Savings Bank,	25	0	0			
,, Balance in Treasurer's hands,	10	4	5½			
	75	4	5½			
				122	4	5½
				£233	13	0½

* On Security of Guaranteed Railway Stock.

Life Members' Fund—			
Invested in 2½ per cent. Debentures of The Modern Permanent Building and Investment Society, Melbourne,	£100	0	0
On loan at 4 per cent.,	47	0	0
	£147	0	0

GLASGOW, 11*th October*, 1898.—We have audited above Accounts, compared same with relative Vouchers and Securities, and find them correct.

(Signed) JAMES JACK,
WM. LEIGHTON. } *Auditors.*

October, 1898.

Natural History Society of Glasgow.

SESSION XLVIII., 1898-99.

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President.

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JOSEPH SOMMERVILLE, 5 Huntly Gardens, Kelvinside.

ALEXANDER SOMERVILLE, B.Sc., F.L.S., 4 Bute Mansions, Hillhead.

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JOHN RENWICK, 49 Jamaica Street.

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JAMES MITCHELL, 222 Darnley Street, Pollokshields.

Honorary Editor of Transactions.

JOHN PATERSON, 82 Cumming Drive, Mount Florida.

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John Fleming.	David Pearson.	George W. Ord.
George Russell.	Hugh Boyd Watt.	Prof. Geo. Bell Todd M.B., C.M.
G. F. Scott Elliot, M.A., B.Sc., F.L.S., F.R.G.S.	Anderson Fergusson.	

Auditors.

James Jack and William Leighton.

LIST OF BRITISH AND IRISH SOCIETIES, &c., WITH WHICH PUBLICATIONS ARE EXCHANGED.

Alnwick.—Berwickshire Naturalists' Field Club.
Banff.—Banffshire Field Club and Scientific Society.
Barrow.—Naturalists' Field Club.
Bath.—Natural History and Antiquarian Field Club.
Belfast.—Naturalists' Field Club.
Natural History and Philosophic Society.
Birmingham.—Philosophical Society.
Brighton.—Brighton and Sussex Natural History Society.
Bristol.—Naturalists' Society.
Cambridge.—The University Library.
Cardiff.—Naturalists' Society.
Chelmsford.—The Essex Naturalist.
Chester.—Society of Natural Science.
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